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THE IDENTIFICATION OF KINDERGARTEN CHILDREN LEAST LIKELY TO SHOW SPONTANEOUS IMPROVEMENT IN SPEECH SOUND ARTICULATION.

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AN ATTEMPT WAS MADE TO DETERMINE WHETHER THE MEASURED ARTICULATION PERFORMANCE OF KINDERGARTEN CHILDREN COULD PREDICT WHICH CHILDREN WOULD DEVELOP SATISFACTORY ARTICULATION AND WHICH CHILDREN WOULD CONTINUE TO MISARTICULATE AND NEED SPEECH THERAPY BY THE SECOND GRADE. IN 1960, 2,150 PREKINDERGARTEN AND KINDERGARTEN CHILDREN WERE GIVEN A PICTURE ARTICULATION TEST AND AN IMITATION ARTICULATION TEST. IN 1962, THE CHILDREN WERE TESTED WITH AN IMITATION ARTICULATION TEST, THE SPENCER ARTICULATION TEST, AND AN INTELLIGIBILITY RATING. FOR EACH OF THESE TESTS A CUTOFF SCORE WAS SET TO IDENTIFY APPROXIMATELY THE SAME PERCENTAGE OF CHILDREN FROM THE TEST GROUP AS WERE RECEIVING SPEECH THERAPY IN ELEMENTARY SCHOOLS. RESULTS SHOWED THE PERCENTAGE OF GIRLS IDENTIFIED BY ALL THREE TESTS WAS SMALLER THAN THE PERCENTAGE OF BOYS. THE 1962 IMITATION ARTICULATION TEST PREDICTION WAS SATISFACTORY FOR BOYS AND GIRLS, BUT SOMEWHAT BETTER FOR GIRLS. THE 1962 SPENCER ARTICULATION TEST PREDICTION WAS SATISFACTORY FOR BOYS AND GIRLS, BUT GENERALLY BETTER FOR THE BOYS. PREDICTION ON THE 1962 INTELLIGIBILITY RATING WAS NOT SATISFACTORY. THE HYPOTHESIS WAS NOT SUPPORTED THAT FEWER CHILDREN SCORING INCONSISTENTLY ON THE 1960 TESTS WOULD NEED SPEECH THERAPY IN 1962 THAN CHILDREN WHO SCORED CONSISTENTLY IN 1960. INCLUDED ARE 24 REFERENCES. (MY)

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March 1967

U. S. DEPARTMENT OF
HEALTH, EDUCATION AND WELFARE

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Bureau of Research

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Project No. 818
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Mildred C. Templin

March 1967

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INTRODUCTION

Misarticulation of the phonemes of English is the most common speech deviation among school children. Over 80 per cent of the case loads of public school speech clinicians is made up of children with deviant production of speech sounds (Bingham, D. et al., 1961). Decisions as to which children should be given articulation therapy in kindergarten and the primary grades are continually being made in school systems across the nation. These decisions are probably most frequently based on such considerations as the number of speech clinicians available, the earliest grade in a school system in which speech therapy has been previously offered, the opinions and preferences of individual speech clinicians, the demands of classroom teachers and parents, and the size of the school budget.

Cross sectional studies have quite consistently found that by seven or eight years of age, most children have reached essential maturity of articulation and thus can satisfactorily produce all the sounds of English (Wellman 1931, Poole 1934, Templin 1957). After this age, any omission or gross distortion of a phoneme, or the substitution of one phoneme for another (e.g. "mi" or "mith" for "miss") can be considered a deviant articulation production. Such deviation in the eight-year-old child identifies an articulation problem, and a potential addition to the articulation case load of the speech clinician. However, in the five-year-old, such deviations in the production of the phonemes of English may or may not signal an articulation problem. Deviant articulation in kindergarten, first or second grade may thus be an indication of slow maturation in the ability to produce the phonemes of English for some children and of deficient development in this ability for others.

Normative and developmental data suggest that many children with misarticulations during their first years in school will produce the sounds of the language accurately by the second or third grade. It is reasonable that therapy should be given those children who are likely to retain deviant articulation into the upper grades. Such children, if therapy is effective, should be given the advantage of additional years of adequate speech sound articulation whenever possible. However, it is neither economically nor professionally reasonable to give speech therapy to primary grade children whose articulation will shortly become satisfactory without it. While it can be assumed that children with deviations such as hearing impairment or malformation of the speech mechanism need speech therapy, in the primary grades the great bulk of the children that constitute the articulation case loads of speech clinicians do not have such organic problems. Many of the children receiving speech therapy are merely slower to develop accurate production of sounds.

The crucial point of the problem is that no criteria have been established for separating, at a point in time before adequate articulation is expected to be almost universally achieved, the child who is slowly developing satisfactory articulation from the child who is and will continue to be, deficient in articulation. That is, the speech clinician has no satisfactory objective guidelines available that will serve to differentiate among children with some misarticulations in the early school years those who will and those who will not need therapy later.

If such criteria could be established their potential value and impact are readily apparent. They would increase understanding of the developmental process. While this in itself is important, such criteria would have many and immediate applications. They would have an important influence in planning speech therapy programs and in the use of the professional skills of the speech clinicians in the elementary schools. Their application would reduce substantially the number of children being given articulation therapy in the primary grades. It would also shift the emphasis of therapy towards the needs of more severe articulatory cases. Thus, professional skills of the speech clinician would probably be concentrated on a fewer number of articulation cases, but the deviations presented by these cases would demand higher level skills. There is no doubt that if such criteria were to be established they would be important not only in the demands placed upon the skill of the speech clinician but also in his preparation for professional work.

Review of Relevant Literature

Of the numerous studies relevant to this report, only those dealing with method of measurement and with prediction of articulation are reviewed here.

Method of Measurement

Since the articulation tests devised for this study included the evaluation of sounds produced in spontaneous utterances elicited by the use of pictures, and in utterances repeated after the examiner, pertinent literature on method of measurement of sounds is reviewed here.

With the exception of the early study by Morrison (1914) all studies reported somewhat higher articulation scores when measurement was based on a repeated than on a spontaneous response, although the level of significance and the interpretation of the differences found varied. Snow and Milisen (1954a) testing articulatory impaired first-, second-, and seventh-graders and Carter and Buck (1958) testing articulatory impaired first-graders reported significantly higher scores (i.e. more adequate production of sounds) using the imitation method.

Templin (1947) tested preschool and kindergarten children on sound elements measured in one spontaneous and two imitative utterances during a single testing session. Results are reported for the 100 subjects on their initial tests and for the 214 tests on these subjects. No significant differences were found between the spontaneous and imitation scores. However, on the 214 tests there was a small increment in score from the spontaneous to the first imitative to the second imitative measure. On the 100 initial tests the spontaneous score fell between the two imitative scores. It may be that since at the time of the initial test the younger children responded to fewer pictures they obtained a higher percentage score on the spontaneous test.

In a recent unpublished study Templin (1967) investigated the effect of an aural model on the measured articulation of kindergarten boys selected initially with articulation scores about the median of kindergarten boys. The articulation of four groups of approximately 35 cases each was tested twice in utterances spontaneously elicited (A) and in imitative utterances (B) as follows: AA, AB, BA, and BB. The higher score was obtained on the test administered second in all instances except treatment BA in which the higher score was obtained on the Imitative rather than the Picture Test. The differences between the scores on the tests administered first or second were significant at the .01 level, however, only for treatment AB and BB.

Some investigators (Snow and Milisen, Carter and Buck, op. cit.) hold that the measurement based on the spontaneous utterance is the better measurement. Templin holds that the purpose of the testing should determine which method is preferable: That the imitative test probably gives a measure of the maximum performance of the child and has the advantages of being more quickly administered, and of permitting evaluation of all test sounds more consistently from child to child; and that the picture test probably gives a measure of the typical performance of the child, and has the advantage of being more attractive to most young children. Divergence in scores obtained on the two types of articulation measures has been suggested as being associated with more rapid improvement of articulation (Snow and Milisen, 1954b: Carter and Buck, op. cit.).

Prediction Studies

Research literature on the prediction of articulation per se is relatively recent and not extensive, despite the central role of prediction to the task of the speech clinician. A brief discussion of the prediction research is presented following the presentation of the studies in chronological order.

Snow and Milisen (1954) studied the predictability of improvement in articulation without therapy based on two methods of measuring articulation. They evaluated 25 consonants, singles and clusters in words uttered spontaneously in response to pictures, and in words repreated after the examiners. They tested 81 first-and second-grade children with speech sound defects using both picture and imitation methods. After six months during which the children received no therapy, they were retested using the picture method only. The authors report that those subjects showing the greatest difference between scores obtained on the picture and imitation measures, improved most in their articulation. They suggest that the difference in a subject's responses to the two types of tests may be a valuable factor in predicting spontaneous articulation improvement. For a given subject they also report that the specific sounds produced better on the imitative test were those that showed the most improvement over the six month interval between testing.

Pettit (1957) studied five-year old children with articulation deviations who were within the normal range of intelligence, hearing, motor coordination, speech mechanism and emotional adjustment. The subjects were given a battery of ten tests including measures of articulation, hearing, motor coordination, intelligence and personality. Seven to eight months later 60 of the 72 subjects originally tested were given the same articulation tests including conversation, rehearsed sentences, isolated words, nonsense syllables and isolated sounds. He reported no significant predictive value for his measures.

Carter and Buck (1958) used ability to correct articulation in imitative situations as a predictor in their investigation of the effect of therapy on first-grade children with defective speech. At the beginning of the school year 175 subjects with functional articulation disorders were first given a spontaneous picture articulation test consisting of 114 pictures representing 13 initial, medial and final sounds. Then, a week later all children who had made at least one sound error were given two imitation articulation tests, one using the same test words as the picture test, the other consisting of nonsense words including the same test sounds. Subjects were divided into two groups, one receiving therapy and the other receiving no therapy over a nine-month period. At the close of the school year, the spontaneous picture test was again administered to all subjects. Analysis of the data for prediction of articulation improvement found that the higher the percentage of correction on the nonsense syllable imitation test the more likely the subject would improve in articulation without therapy. No substantial evidence was found for the predictive value of the imitation test using words.

Steer and Drexler (1960) investigated the predictive value of kindergarten measures of Goodenough Draw-a-Man IQ, Vineland Social Maturity SQ, CA, a number of articulation scores and rating of improvement during a 12 week speech improvement program (for those subjects with more than 3 errors on the first test) on fifth grade articulation performance as measured by the Wilson Articulation Test and the Templin Non-Diagnostic Articulation Test. Subjects were 93 subjects who had had at least one articulation error in kindergarten after a 12-week speech improvement program. They were divided into two groups, 54 who had participated in a later speech improvement program and 39 who had followed regular classroom procedures. Results on both measures of articulation in fifth grade were apparently similar, but only those on the Templin test were reported. Using the Wherry-Doolittle test selection method on all predictive variables - 12 consonant sounds, CA, SA and MA - the best prediction was obtained using a regression formula including the total number of errors in kindergarten on /f/, /l/ and /θ/. Additional analyses suggested that improvement over a 12-week period in kindergarten can predict further long-range articulation improvement.

Farquhar (1961) explored the predictive value of tests of auditory discrimination and ability to imitate the correct form of misarticulated sounds in 50 "mild" and 50 "severe" articulatory defectives. Subjects were selected from 300 kindergarten children in their second week of school on the basis of performance on a spontaneous picture articulation test measuring the 14 most frequently misarticulated sounds. Those subjects who misarticulated one sound in at least two positions were classified "mild", and those with the lowest Wood Articulation Indexes made up the "severe" group. Examination procedures on imitation of sounds, nonsense syllables and words and on auditory discrimination were individualized so that each child was tested only on his misarticulations. Seven months later subjects were retested on the spontaneous picture test. The articulation of both mild and severe deviation groups improved significantly without therapy. Auditory discrimination tests were not predictive of improvement for either group. Ability to imitate the correct form of a misarticulated sound in words was a significant predictive measure at the .01 level for the mild and at the .05 level for the severe articulation deviation groups.

Dickson (1962) investigated differences in motor proficiency, auditory discrimination and parents' emotional characteristics between children who spontaneously outgrew articulation errors and those who retained them over the period of one year. Thirty subjects who had retained their articulation deviations and thirty who had not were selected on the basis of the Hejna Articulation Test and an oral examination by three examiners from first, second and third grade children who the year before had been judged to have functional articulatory defects. Subjects were given the Oseretsky Tests of Motor Proficiency, the Templin Short Test of Sound Discrimination and their parents took the Minnesota Multiphasic Personality Inventory sent them by mail. Subjects who had spontaneously improved their articulation completed significantly more gross motor tasks than those who had not. No significant differences were found between the groups on sound discrimination or their parents' MMPI profiles.

Pronovost (1966) refers to the body of work investigating prediction of articulation carried on by himself and his associates at Boston University in a discussion of selection of cases for articulation therapy in the public schools. In a recent dissertation Sandy (1965) studied changes in articulation proficiency over a seven-month period in relation to intelligence, speech sound discrimination, speech musculature coordination, personality factors and verbal output in children. The majority of children whose articulation proficiency shifted from well below the mean to well above the mean over the period had above mean scores on all variables tested. The authors point out that these results suggest that subjects with misarticulations will more likely improve without therapy if their performance is above average on the tests included in the predictive battery.

Van Riper and his associates (1966) present the most extensive investigation into the problem of prediction. For some eight years Van Riper has been working toward constructing a predictive test that can identify among first-grade children with articulatory defects those who will overcome their misarticulations without therapy. From a review of the literature and interviews with parents, teachers and speech clinicians he assembled a pool of 500 potential test items. These were reduced to 200 by a panel of six experienced speech clinicians who were given the goal of selecting attractive items that could be administered to first-grade children within five to ten minutes. After a pilot run of the items on 60 cases twice tested by speech clinicians, the number of test items was reduced to 135. These 135 items were given to 167 beginning first-grade children with "state certified speech defects" in 1962 and repeated with the same subjects in 1963 and 1964. An item analysis carried on to select items that discriminated those children who did and did not spontaneously eliminate their misarticulations has been sufficiently promising that in 1965 a cross validation study of 293 first-grade children was undertaken.

Discussion. The studies reviewed can be considered prediction studies only in a very broad sense. Some of them were concerned with the early identification of subjects who would improve in their articulation production over the years. Others were concerned with the identification of factors that differentiated between subjects, initially classified as deviant in articulation, who did and did not improve in their articulation production. They represent all the studies dealing with the general problem that could be located.

Subjects in all of the studies reviewed are in the early school years. Most studies attempt prediction of articulation performance over a relatively short period, usually one or two school years. In all of the studies at the initial testing the subjects were identified as having deviant articulation. The definition of such deviation is inconsistent from study to study. In some, the few misarticulations necessary to be included in the sample raises the question if such articulation can be considered deviant during the early school years.

For the most part, articulation performance at the termination of the studies was determined by articulation tests - either the same or different from those given initially. Performance in articulation at the final testing is considered in the analyses of the data. Concern with attainment of deviant versus normal articulation is implied, although not necessarily expressed, in the studies. However, no objective criteria for acceptable or unacceptable articulation nor interpretations of the level of articulation performance at the terminal testing periods are given.

The degree of successful prediction or identification varies among the studies. There is some suggestion, however, that more discriminating results are obtained if some aspect of articulation (e.g. articulation of specific sounds or shift in articulation as sounds are evaluated in a spontaneous or a repeated utterance) rather than other variables are used to predict performance or to identify the characteristics of contrasted groups. There is no indication of systematic exploration of the predictive value of the main potential predictors considered in the studies.

For the most part the studies show considerable insulation from one another. Prediction must occur over time, and this necessary longitudinal aspect of its investigation may at least partially account for the relatively few published studies, and the dearth of validation of results on separate samples.

In a problem as many-faceted as prediction of articulation it is likely that only concentrated long-term investigation will yield meaningful results. Some of this has been going on with a number of investigators at Boston University. To date, however, the work of Van Riper represents the most continued commitment to the problem, and probably holds the most immediate promise, since it is a systematic, step-by-step effort to construct a prediction test. An overview of relevant research points up the need for more systematic investigation in this important area.

THE STUDY

The study reported here is one part of a more comprehensive investigation concerned with the longitudinal development and prediction of articulation and with the relation of articulation production to a number of language and nonlanguage related variables. The comprehensive study has been supported through USOE projects #818 and #2220.[1]

As originally planned Project #818 dealt with two samples: (1) A large number of subjects whose articulation was measured in prekindergarten and/or kindergarten and again in second grade; and (2) A smaller number of subjects selected for longitudinal study from those tested in prekindergarten who were to be more intensively and extensively followed through the second grade. The subjects in the longitudinal sample were tested at six-month intervals on articulation performance, and, periodically, on performance in related areas such as auditory and visual discrimination, language, reading, and personality.

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[1] Project #2220, "Longitudinal Study through the Fourth Grade of Language Skills of Children with Varying Speech Sound Articulation in Kindergarten."

Since by second grade fewer subjects than had been anticipated from available cross-sectional data had achieved adequate articulation, the intensive longitudinal study was continued through the fourth as Project #2220. Analyses of data obtained during the kindergarten, first and second grades on the longitudinal sample per se will be incorporated with those of data obtained through the fourth grade and presented in the report of Project #2220.

Purpose

The purpose of the study reported here was to determine whether the measured articulation performance of kindergarten subjects could, in second grade, successfully identify those subjects who did and those who did not need therapy. Relationships between articulation and measured performance in areas other than articulation are investigated in the total project. No analyses of such data could be presented in this report, since, for most of the subjects in this study, only articulation test data were available.

Several aspects of early articulation performance are explored as predictors of later articulation performance. Systematic analyses were made to determine whether articulation subtests administered in kindergarten or prekindergarten could predict performance in second grade. One hypothesis tested was that children whose kindergarten articulation of a phoneme was inconsistent when evaluated in a spontaneous or repeated utterance would show rapid improvement in articulation and would likely not need speech therapy in second-grade. In effect, this states that although a subject did not spontaneously produce a sound correctly, the fact that he did after presented with an aural model, indicated that he would soon produce the sound correctly with no aural model presented.

The study reported here is part of a concerted attempt to investigate the development of articulation and its relation to other language and nonlanguage behavior. As such, it is the report of one of a number of investigations relating to development of satisfactory articulation during the early school years. Specifically it represents an initial attack upon the important problem of establishing criteria for differentiating kindergarten children whose adequate articulation is developing more slowly from those whose articulation is and will continue to be deficient. Obviously such goals cannot be attained in a single study. The study reported is an initial attack upon them.

METHOD

The study is a short term longitudinal design in which children were tested as follows:

Spring 1960 - Initial testing of prekindergarten subjects

Fall 1960 - Initial testing of kindergarten subjects
Retesting of prekindergarten subjects

Fall 1962 - Retesting of all subjects.

The number of subjects tested and the schedule of testing them has made it possible to determine the predictive value of certain articulation measures with some of the subjects and to test the stability of prediction with others. Since data on all subjects were gathered in the same testing periods, cross-validation did not have to wait upon the gathering of additional data.

Sample

In this study, 2150 subjects, 1004 boys and 1146 girls were tested once or twice in 1960 and retested in Fall 1962. This number constituted all subjects tested in 1960 who could be located within the Minneapolis metropolitan area in Fall 1962. It is 29.3 per cent of the 7,333 children enrolled in Minneapolis kindergartens in Fall 1960.

Although the 2150 subjects are some 300 fewer than were initially tested in Fall 1960, there is no reason to believe that they are not an essentially unselected sample of 1960 Minneapolis kindergarten children. The prekindergarten subjects first tested in Spring 1960 were enrolled in 45 Minneapolis elementary schools in the fall of that year. The schools were widely distributed geographically throughout the city, represented all socioeconomic levels, and were not selected according to any identifiable bias. In Fall 1960 testing was carried on in the same schools as in the spring of that year. In Fall 1962, the subjects were retested in 50 Minneapolis public and 74 parochial or suburban schools.

To identify schools that would participate in the study, a letter describing the project and asking for participation in it was sent in early 1960 over the signatures of the project director and the Director of Special Education in the Minneapolis Public Schools to the principals of the 74 Minneapolis elementary schools. (See sample letter in Appendix B). In response to the letter all except ten of the schools were made available for testing. These ten schools were unable to participate because of limited space, problems of scheduling access to children not yet attending school, or previous committments to other studies. However, because of limitations of time and personnel, it was not possible to include all schools that were available for the initial Spring 1960 testing. Those schools in which the testing was carried on in Spring 1960 were selected only because it was possible for them to provide prekindergarten children and space for testing at times that would fit into the schedules of the speech clinicians doing the testing.

Children first tested in Spring 1960 were brought to the schools to be tested before they entered kindergarten, but those who were first tested in Fall 1960 were not. The latter were unselected children from the same kindergarten classes as the former. There is some possibility that parents of the former children might be somewhat more concerned about the speech of their children, or that these children might have more deviant speech. However, this possibility was minimized in that children were brought for testing after their parents had received a single-page statement indicating that children with both good and poor speech were needed for the study, and that speech therapy was not included as part of it. (See Appendix B for statement - Information on Speech Study.)

For purposes of analysis, the 2150 subjects were divided into several samples and boys and girls were kept separate. Sample A-1 was made up of subjects with even case numbers who were first tested in Fall 1960. Sample A-2 was made up of subjects with odd case numbers who were first tested in Fall 1960. Sample B is made up of subjects tested both in Spring and Fall 1960. The designation Sample B-I refers to performance of Sample B subjects in Fall 1960. The designation Sample B-II refers to their performance in Spring 1960. Designations of the B Sample were assigned on the basis of later analysis.

Table 1. Characteristics of Samples in Fall 1960: Mean CA, Number of Children in Family, and Position of Subject among Children in Family.

		CA in Months		Number of Children		Position in Family	
	N	$\bar{X}$	SD	$\bar{X}$	SD	$\bar{X}$	SD
Sample A-1 Boys	202	64.01	3.98	3.6	1.68	2.6	1.54
Sample A-1 Girls	282	63.41	3.49	3.6	1.55	2.6	1.43
Sample A-2 Boys	209	64.02	3.96	3.8	1.76	2.8	1.62
Sample A-2 Girls	278	63.62	4.05	3.5	1.53	2.6	1.38
Sample B-I Boys	593	63.96	3.50	3.8	1.59	2.5	1.41
Sample B-I Girls	586	63.73	3.45	3.8	1.60	2.5	1.42

Table 1 presents for the several samples by sex the mean age, mean number of children in the family, and the mean position of the subject among the children in his family as of Fall 1960. It is apparent that the several subsamples are very similar on these background variables. The range of fathers' occupations as classified on the Minnesota Scale of Paternal Occupations[1] covers the entire scale for each sample. The mode for each sample is Class V, Semi-skilled occupations, minor clerical positions and minor business. Intelligence test data were not available for all subjects.

Measures Used

Since the tests used were devised for this study or were previously used only as research instruments rather than as standardized tests they are presented in Appendix B. Throughout the report measures are referred to in relation to the date at which they were administered.

1960 Measures. In both Spring 1960 and Fall 1960 the same Picture and Imitation Articulation Tests were administered. Scores on the subtests of these measures serve as the independent variables in the analyses. The Picture and the Imitation Tests contain the same sound items and differ only in the way in which the utterance to be evaluated was elicited. All sounds were evaluated as they were produced in English words. In the Picture Articulation Test the sounds were evaluated in words elicited from the subjects by pictures[2] mounted on 4 x 6 cards. No aural model was given but the child was asked to "tell what this is a picture of." In the Imitation Articulation Test the sounds were evaluated in the same words repeated after the examiner had said them and had thus presented an aural model to the subject.

The articulation tests administered in 1960 evaluated 47 sound items in 29 words. They were selected on the basis of performance of the 4- and 4½-year-olds in Templin's normative study (1957). In this study 60 children, 30 boys and 30 girls, were tested at each half year level between three and five years and at each year level between five and eight years. They formed a representative sample according to their fathers' occupations and were tested within one month of their designated ages. The 1960 Picture and Imitation Articulation Tests included all consonants uttered by fewer than 56 (i.e. 92 per cent) of the 4- and 4½-year-old children in the normative sample, all semi-vowels, and selected /s/, /l/ and /r/ clusters. Selections of items was made by the project director after conferences with speech clinicians in the Minneapolis Public Schools, and the

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[1] Published by the Institute of Child Development, University of Minnesota, Minneapolis, Minnesotat 55455.

[2] Pictures for the most part were taken from Oftedal, Laura and Jacob, Nina, My First Dictionary, New York: Grosset and Dunlap. 1948

Speech Pathology faculties of the University of Minnesota and the State University of Iowa. Specific items in the 1960 articulations tests were: Phonemes tested in both initial and final positions, /θ/, /s/, /ʃ/, /v/, /ð/, /z/, /r/, /l/, /tʃ/, /dʒ/; phonemes tested in the initial position only, /h/, /w/, /hw/, and /j/; phonemes tested in the final position only, /m/, /n/, /ŋ/, /p/, /t/, /k/, /b/, /d/, /g/, /f/, / /; the /s/ in initial clusters /sm/, /st/, /sl/, /str/; the /l̩/ and the /l/ in cluster /fl/, /gl/, /s l/; the /ð/ and the /r/ in clusters /tr/, /br/, and /str/. Throughout the report the latter three groups are referred to as clusters despite the inclusions of syllabic sounds.

Subtests and the maximum possible raw scores for the 1960 Picture and Imitation Articulation Tests were:

Total Test	47
Total Test Minus /hw/	46
Total Consonants (minus /hw/)	34
Initial Consonants (minus /hw/)	13
Final Consonants	21
Total Clusters	21
/s/ Clusters	12
/l/ Clusters	4
/r/ Clusters	4

The /hw/ was not included in the scores for Initial Consonants, Total Consonants, and Total Test minus /hw/ because it was the only phoneme on which correct production did not increase with the age of the subjects in Templin's normative study (1957).

For most subjects all items on the 1960 Imitation Articulation Test were able to be evaluated. On the 1960 Picture Articulation Test, however, the number of items that could be evaluated varied because the desired word-response could not always be elicited. Thus, a percentage score based on the number of correct responses among the total number of items evaluated has been used for the articulation tests throughout this report.

1962 Measures. In Fall 1962 three criterion measures were obtained: 1) the 1962 Imitation Articulation Test; 2) the 1962 Spencer Articulation Test, and 3) the 1962 Intelligibility Rating.

The 1962 Imitation Articulation Test was devised for this study, and except that it was more complete evaluation of the consonant phonemes in the initial and final position in syllables, was similar to the 1960 Imitation Articulation Test. Nine initial phonemes that had been omitted from the earlier test were added: /m/, /n/, /p/, /t/, /k/, /b/, /d/, /g/, /f/. Although a number of subtest scores were obtainable, in the study here reported the percentage scores for the Total Test Minus /hw/ based on a maximum raw score of 55, was used as a criterion score.

Spencer (1958) devised a measure of the young child's ability to produce the sounds of English in nonsense words when an aural model was provided for him by the examiner. The instrument measures both vowels and consonants, and a number of subscores are obtainable. As used in the present investigation, the 1962 Spencer Articulation Test measures initial and final consonants minus /hw/ as produced in nonsense words. The maximum raw score is 44. A percentage score based on the 44 items evaluated is used in this study.

The 1962 Intelligibility Rating evaluated subjects on a three-point scale, indicating that the examiner had: (1) no difficulty in understanding the subject; (2) some difficulty in understanding the subject; (3) considerable difficulty in understanding the subject.

Not until second-grade was any attempt made to identify those subjects with speech sufficiently deviant to indicate the need for articulation therapy. Deviant articulation was then defined by that rating on Intelligibility or that score on the Imitation and Spencer Articulation Tests at or below which the percentages of boys and girls that have quite consistently been reported for elementary schools as needing therapy would be expected to fall.

Administration of Tests

All subjects were tested individually by speech clinicians who, for the most part, were at the MA level, and had had some experience in the public schools. Before each testing period, training sessions were conducted with the examiners to ensure maximum agreement on procedures of testing and maximum reliability of judgments on the evaluation of sounds produced. Only judgments of the correctness or incorrectness of utterances were used in this report although the examiner noted whether an omission or an inappropriate utterance accounted for the incorrect production. Over the years, reliability statistics on such gross judgments by trained examiners have been relatively high (Henderson, 1938; Wright, 1954).

To increase the reliability of judgments several rules were laid down for testing procedures. First, when evaluating the subject's production of the test phoneme, the examiner watched the subject as he produced it and took account of both auditory and visual cues. Thus, a /t/ that was acoustically satisfactory would be considered incorrect if it was produced with the tongue protruding. Of course, any sound whose production was acoustically unsatisfactory was considered incorrect. Secondly, if the examiner found it difficult to evaluate a particular utterance, he would ask the subject to repeat, speak more loudly, to look at the examiner, etc. without using the desired response-word. If, after a sound was produced a second time, the examiner was still uncertain of the accuracy of its production, the sound was considered as incorrectly produced. If the examiner was uncertain as to whether any utterance was correct or incorrect, the sound production was considered incorrect.

In the 1960 testing, the Picture Articulation Test was mimeographed on one side of the test blank, and the Imitation Articulation Test on the reverse side of the same sheet. This was done in order to minimize the liklihood that the evaluation of utterances repeated after the examiner would be influenced by the evaluation of the subjects' previous spontaneous production of the sound.

Method of Analyses

Prediction of performance in Fall 1962 was carried out separately on the 1962 Imitation Articulation Test, the 1962 Spencer Test, and the 1962 Intelligibility Rating. On each criterion measure speech failure was determined by that which selected seven to ten per cent of the subjects. This percentage was selected since it has been quite frequently reported in the literature for the occurence of articulation deviations in the elementary school (Bingham et al., 1961). The same cut-off scores were used for boys and girls since a single standard of articulation performance was desired, although more boys than girls could be expected to be identified as failures. The cut-off scores indicating speech deviations on the three criteria measures follow:

1962 Imitation Articulation Test needs speech therapy at or below score 45

1962 Spencer Test needs speech therapy at or below score 36

1962 Intelligibility Rating needs speech therapy at rank 2 and 3

All analyses were carried out separately for boys and girls. Because of the large number of cases and the pattern of testing, it was possible to first determine a prediction on Sample A-1, and then apply it to Samples A-2, B-I, and B-II. This meant that the prediction was validated on half of the sample on which it was first determined, and on a comparable sample tested at the same time but different in that subjects had been brought by their parents for previous testing. The stability of the prediction was also tested on the performance of subjects in the latter sample over a six-month longer time span.

It was hoped that if any prediction procedure would be developed that it could be of use to speech clinicians. Thus it was first necessary to determine if any satisfactory prediction could be made, and then if it could, to simplify the technique of prediction as much as possible. Discriminant analyses using 17 subtests were first carried out (Anderson 1958, Cramer, E. and Bock, R. 1966). Multiple linear regression analyses were then carried out to reduce the number of subtests used in prediction. When warranted, discriminant analyses were computed using three subtests. This number was an arbitrary selection since it seemed that calculations based on three measures would not be prohibitive for clinician's use if good prediction could be obtained. Lastly, the adequacy of prediction of single subtests was investigated.

Because of certain restrictions of the computer programs[1] used and because of limitations of the data available, certain arbitrary decisions were made during the analyses. In the first discriminant analyses carried out the number of subtests had to be reduced from 18 to 17. In the analyses all 1960 Picture and Imitation Articulation subtests were used except the Picture Articulation total test score. This subtest was eliminated for several reasons. Picture articulation measures were more likely to be based on evaluation of an incomplete number of test items than imitation articulation measures. The correlations between scores on 1960 Total Test and Total Test Minus /hw/ were high. In Appendix A Tables A-5 and A-6 it is seen that the correlation of the scores in these two subtests in .998 for Sample A-1 boys and .997 for Sample A-1 girls for both the imitation and picture measures. Exclusion of the /hw/ item is logical since it is the one phoneme that was produced accurately by more midwestern children at an older age (Templin, 1957).

Restrictions in the multiple linear step-wise regression analysis program were such that no variable included could equal the sum of any combination of other variables. Thus three subtests - Total Test minus /hw/, Initial Consonants, and Total Clusters - were eliminated from both the 1960 Picture and the 1960 Imitation Articulation Tests. Twelve of the 18 subtests were then included in the analysis. The /s/, /l/ and /r/ Clusters were retained rather than Total Clusters Subtest so that the effect of the three specific phonemes that most frequently occur as articulation deviations among elementary school children could be noted. Retention of the Final Consonants Subtest permitted a greater number of consonant phoneme items to be included since nine initial consonants had been eliminated in the construction of the 1960 articulation tests. Because the /hw/ was eliminated in the score of the Total Consonant Subtest, it was necessary to retain the Total Test if a measure approximating the entire test was to be included.

For prediction based upon single variables only the 1960 Imitation Articulation subtest scores were used because correlations between the scores on the same subtests in the Picture and Imitation Tests given at the same testing session are quite consistently very high for all samples (Table 2). Imitation scores were used because they are based on more complete measurement of sounds.

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[1] Data were analyzed using the 1604 computer at the Numerical Analysis Center, University of Minnesota.

Table 2. Correlations between the Same Subtests on 1960 Picture and Imitation Articulation Tests for Boys and Girls by Sample.

Picture versus Imitation		Sample A-1		Sample A-2		Sample B-I		Sample B-II	
		Boys	Girls	Boys	Girls	Boys	Girls	Boys	Girls
	N=	202	282	209	278	593	586	593	586
Total Test		.94	.96	-	-				
Total minus /hw/		.95	.96	.95	.96	.97	.96	.96	.93
Total Consonants		.93	.93	.94	.94	.95	.93	.93	.89
Initial Consonants		.90	.90	.88	.89	.91	.88	.88	.86
Final Consonants		.90	.90	.90	.91	.93	.88	.66	.85
Total Clusters		.93	.92	.91	.92	.95	.95	.93	.90
/s/ Clusters		.91	.90	.86	.90	.92	.94	.88	.87
/l/ Clusters		.88	.90	.90	.86	.93	.88	.87	.83
/r/ Clusters		.93	.83	.88	.85	.92	.92	.85	.84

To determine the prediction using single subtests the scores on the nine subtests of the 1960 Imitation Articulation test were ordered separately for boys and girls in each sample on the sorter and print-outs were made. The print-outs were used to locate the position of the serial distribution of the subjects identified as needing speech therapy on the 1962 criterion measures.

The discriminant analysis technique does not result in any level of confidence for predictions made. The goodness of prediction is probably best presented in a chart:

S'62-F'60 1962 testing: Subject needs no speech therapy (Success) 1960 testing: Subject needs speech therapy (Failure)	S'62-S'60 1962 testing: Subject needs no speech therapy (Success) 1960 testing: Subject needs no speech therapy (Success)
F'62-F'60 1962 testing: Subject needs speech therapy (Failure) 1960 testing: Subject needs speech therapy (Failure)	F'62-S'60 1962 testing: Subject needs speech therapy (Failure) 1960 testing: Subject needs no speech therapy (Success)

Subjects identified as needing speech therapy in 1962 or with scores below an arbitrary cut-off in 1960 are referred to as speech failures. Subjects not needing therapy in 1962 or with scores above an arbitrary cut-off in 1960 are referred to as speech successes. To facilitate comparisons among the many predictions made, data throughout the report are presented in tabular form under the underlined headings of the four quadrants presented above.

Comparisons were systematically made on each distribution with cut-off points that correctly predicted 75, 80 and 85 per cent of the subjects identified as speech failures. Prediction is referred to as good or satisfactory if the percentage of speech successes correctly predicted reached at least the same percentage as speech failures correctly predicted. Thus prediction at the 75 per cent cut-off was "good" if more than 75 per cent of subjects needing and not needing speech therapy were correctly predicted; at the 80 per cent cut-off if more than 80 per cent of both groups were correctly predicted; etc.

RESULTS

In this section results are presented under the headings: Comparison of Samples; Prediction on 1962 Imitation Articulation Test; Prediction on 1962 Spencer Articulation Test; Prediction on 1962 Intelligibility rating; and Inconsistent 1960 Articulation Scores.

Comparison of Samples

Since similar analyses are carried out on separate samples the performance of the samples on predictor and criterion variables was examined. Mean percentage scores for all the samples on the 1960 Picture and Imitation subtests are presented in Appendix A.

Although no significance of differences between scores has been calculated, inspection of Tables A-1 through A-3 shows that scores on the subtests fall within the same range for Samples A-1, A-2 and B-I; that for all samples the scores on the Imitation subtests are somewhat higher than on the Picture subtests; and that the scores of girls are higher than those of boys. The scores of boys in Sample B-I are slightly lower than boys in Samples A-1 and A-2. The scores of girls in these three samples are quite comparable.

For Sample A-1, the one sample on which they are presented, scores on the Total Test are slightly lower than scores on the Total Test minus /hw/. This finding confirms previous investigations by the project director that indicate a better total articulation score is obtained with the /hw/ omitted.

Scores obtained by boys and girls as Sample B-II subjects (tested Spring 1960) are consistently only slightly lower than those obtained when they were tested in Fall 1960 (Tables A-3; A-4).

In Tables A-5 through A-12 the intercorrelations of scores on the Picture and Imitation Subtests are presented for boys and girls separately by sample. The range of correlations from moderate to very high is similar for all samples including B-II. Correlations between specific phoneme cluster subscores are lowest: ranging from about .3 to near .4 between /s/ and /r/ or /l/ clusters, and from about .4 to .6 between /l/ and /r/ clusters. In general, correlations between initial and final consonant scores range between .7 and .8 except for boys in Sample B-II on the Picture Subtest (r=.55). With few exceptions correlations for all samples between the Total Test minus /hw/ (or Total Test where available) and Total Test, Initial Consonants, Final Consonant and Total Cluster Subtests (both Picture and Imitation) are above .9. Boys in Sample B-II show somewhat more variability on Picture Subtests (r's between .68 and .98).

In Tables A-13 through A-15 correlations between 1960 scores and subjects' Fall 1960 CA, position in family and the number of children in the family are presented for both sexes by sample. The magnitude of the correlations is very low and does not differ among samples. For all samples on both Imitation and Picture Subtests, correlations with CA range between -.05 and +.11 for boys and between -.07 and +.19 for girls; with position of child in the family between -.21 and +.11 for boys and from -.01 and -.18 for girls; and with number of children in family between -.01 and -.26 for boys and between -.03 and -.24 for girls. While the sign of the correlations with CA is inconsistent, practically all correlations with the other two variables are negative. The magnitude of comparable correlations for Sample B-II is similar (Table A-16).

Table 3. Fall 1962 Mean Scores on Criterion Measures for Boys and Girls by Sample.

Sample	N	Imitation		Spencer		Intelligibility	
		$\bar{X}$	SD	$\bar{X}$	SD	$\bar{X}$	SD
A-1 Boys	202	50.62	5.00	40.77	3.80	1.10	0.34
A-1 Girls	282	51.68	4.40	41.38	3.23	1.05	0.24
A-2 Boys	209	50.42	5.84	40.37	4.38	1.12	0.45
A-2 Girls	278	51.36	4.78	41.10	3.75	1.05	0.26
B - Boys	593	50.14	5.73	40.24	4.32	1.15	0.43
B - Girls	586	51.76	4.14	41.45	3.04	1.07	0.27

Table 3 presents mean scores on the 1962 Imitation and Spencer Articulation scores and the Intelligibility rating by sex and sample.

The samples are very similar. Girls consistently are rated or have scored at a slightly higher level than boys. The mean scores of girls and those of boys are comparable from sample to sample.

Prediction on 1962 Imitation Articulation Test

The percentage of subjects identified as needing speech therapy (speech failures) on the 1962 Imitation Articulation Test was substantially higher for boys than for girls in all samples. However the highest percentage of speech failures was identified among the boys in Sample B (Table 4).

Table 4. Number and Per Cent of Failures Identified in Fall 1962 on Imitation Articulation Test by Sex and Samples.

	Boys Sample			Girls Sample		
	A-1	A-2	B	A-1	A-2	B
Number Failures	21	22	92	14	16	44
Number Subjects	202	209	593	282	278	586
Per Cent Failures	10	10.5	15.5	5	6	7.5

Correlations between each of the seventeen 1960 Imitation Articulation Subtests and scores on the 1962 Imitation Articulation Subtest are in general comparable from sample to sample (Appendix Table A-17). All correlations except those for the specific phoneme cluster subtests range essentially between .5 and .6 for girls and boys on both Picture and Imitation Subtests on all tests given in Fall 1960. (This holds for Samples A-1, A-2 and B-I.)

For Sample B-II boys the correlations between the 1962 Imitation Articulation test and the subscores obtained in Spring 1960 are similar to those obtained in Fall 1960 with the exception of the Picture Final Consonant Subtest (r=.38). For girls, however, the correlations with all Spring 1960 Picture and Imitation Subtests except the specific phoneme clusters are of a slightly lesser magnitude (r in .4 and .5 range) than those obtained for Samples A-I, A-2 and B-I in Fall 1960.

Correlations between the 1962 Imitation Articulation Test and each of the specific phoneme cluster subtests (/s/, /l/ and /r/) for boys and girls in all samples range more widely. Although a few correlations are above .5, most are equally divided between .3 and .4.

Distributions of predictions based on discriminant analyses using seventeen and three subtests and on single subtests are presented for each sex and sample in Tables A-18 through A-21. Tabulations are by number and percentage with cut-off points selected so that 75 and 80 per cent of the subjects needing therapy (speech failures) are correctly predicted. Prediction at any cut-off is considered good if the same percentage of speech failures and speech successes are identified.

Prediction of those subjects needing and not needing speech therapy based on seventeen 1960 Articulation Subtests was good for both sexes in Sample A-1 when the cut-offs were made to accurately predict 75 and 80 per cent of the speech failures, (Table A-18). Prediction, however, was somewhat better for girls. For girls in Sample A-1, if the cut-off was made to predict 86 per cent of the speech failures, 98 per cent of the speech successes were also predicted (Table A-18). Only 14 per cent, or two of the speech failures and 2 per cent or five of the speech successes were not predicted correctly. For boys in Sample A-1 if the 86 per cent of the speech failures were predicted 81 per cent of the speech successes were predicted accurately.

When the discriminant function coefficients for the seventeen subtests were applied to Sample A-2 good prediction held up for the girls when the cut-off was at 75 and the 80 per cent prediction for the speech failures (Table A-19). When 88 per cent of the speech failures were correctly predicted, 79 per cent of the speech successes were also correctly predicted for the girls (Table A-19). The prediction for Sample A-2 boys was not good at any of the cut-off points. When the cut-off was made to predict 75, 80 and 85 per cent of the speech failures, 68, 52 and 33 per cent of the speech successes were correctly identified.

To reduce the number of subtests to be used in prediction a stepwise multiple linear regression analysis was first carried on. The order in which the subtests were deleted in the analysis is presented in Table 5. The range in correlations between the 1962 Imitation Articulation test and from one to twelve of the subtests is less than .03 for both boys and girls.

The magnitude of the correlations over the two-year span is substantial. Inspection of the correlations showed that although different variables were the last to be deleted for boys and girls, for neither sex was there a point at which deletion of any subtest made a significant change in the magnitude of the correlation obtained.

Table 5. Step-wise Multiple Linear Regression Analysis. Twelve 1960 Picture and Imitation Articulation Subtests on 1962 Imitation Articulation Test for Boys and Girls, Sample A-1.

Number of Subtests	Boys Sample A-1	
	R	Deleted Subtest
12	.5902	P - Total Consonants
11	.5902	P - Total Test
10	.5901	I - Final Consonants
9	.5892	P - /s/ Clusters
8	.5884	I - /r/ Clusters
7	.5870	P - /r/ Clusters
6	.5864	I - /s/ Clusters
5	.5826	I - Total Consonants
4	.5812	P - Final Consonants
3	.5783	P - /1/ Clusters
2	.5701	I - /1/ Clusters
1	.5663	I - Total Test

Number of Subtests	Girls Sample A-1	
	R	Deleted Subtest
12	.5939	P - /1/ Clusters
11	.5939	I - Total Test
10	.5939	P - /r/ Clusters
9	.5936	P - /s/ Clusters
8	.5935	P - Total Consonants
7	.5933	I - Final Consonants
6	.5921	P - Total Test
5	.5903	P - Final Consonants
4	.5890	I - /1/ Clusters
3	.5866	I - /r/ Clusters
2	.5786	I - /s/ Clusters
1	.5657	I - Total Consonants

The three subtests selected from among the last four to be deleted were: for boys, Picture /1/ Cluster, Imitation /1/ Cluster and Total Imitation; for girls, Imitation /1/ Cluster, Imitation /r/ Cluster and Imitation Total Consonants. Using these variables in a discriminant analysis with boys and girls in Sample A-1, the percentages of speech failures and speech successes correctly predicted at 75 and 80 per cent cut-offs were, for both sexes, practically identical with those found using seventeen subtests (Table A-18). When the cut-off was made at 85 per cent prediction using three subtests was about the same for boys and only slightly less satisfactory for girls than when seventeen subtests had been used (Table A-18). For girls three subtests correctly predicted 86 per cent of speech failures and 92 per cent of speech successes. For boys three subtests predicted 86 per cent of speech failures and 83 per cent of speech successes.

Discriminant function coefficients for the three subtests were applied to boys and girls in Samples A-2 and B-I to validate the prediction and to Sample B-II to determine the stability of prediction over a six month longer period. For boys, the prediction was also calculated using the Total Test minus /hw/ rather than Total Test score. This substitution was made since the latter is the better test, but it was not possible to include it in the step-wise regression analysis because it is the total of several of the subtests used.

Prediction for boys is good for Sample A-2 (Table A-19) and Sample B-I (Table A-20) when the cut-off is placed to predict 75 per cent of speech failures, but not when the cut-off was placed to predict 80 or 85 per cent of the speech failures. Prediction is about the same whether the score on Total Test or Total Test minus /hw/ is used. The prediction for Sample B-I is considerably better than for Sample A-2. For Sample A-2 predictions based on three subtests are better than those based on seventeen subtests.

For girls prediction based on three subtests is about as good as that based on seventeen for Sample A-2 when cut-offs are placed to predict 75, 80 and 85 per cent of speech failures. Good prediction holds for Sample B-I when cut-offs are at 75 and 80 per cent. However when 86 per cent of speech failures are predicted, the percentage of speech successes falls to 79 (Table A-20).

Prediction is made over a six month longer period with Sample B-II. For boys the predictions are as good over the two-and-a-half as over the two year period. For girls only slightly less adequate prediction is made over the two-and-a-half year period, but it is as good a prediction as is obtained for the boys.

The optimum cut-off on the three subtests analyses for girls is probably at about 85 per cent of those subjects needing therapy for prediction from Fall 1960 to Fall 1962. When applied in Sample A-1 this cut correctly predicts 86 per cent of the failures and 92 per cent of the successes; for Samples A-2 and B-I the percentage of correctly predicted successes decreased only to 89 and 79, respectively. However, when prediction is attempted over the two-and-a-half year period (from Spring 1960 to Fall 1962) the percentage in the successes correctly predicted is decreased to 62. An 85 per cent correct identification of speech failures is too high for boys. When the cut-off is made at this level the percentage of speech successes correctly predicted is 83, 57, 65 and 70 per cent for Samples A-1, A-2, B-I and B-II respectively.

In Table A-22 the discriminant function coefficients for each of the three Subtests and the discriminant values used for the cut-off predicting 75, 80 and 85 per cent of the subjects needing therapy in Fall 1962 are presented.

Examination of distributions in the several categories of prediction (See Tables A-18 to A-21) indicates that at the 75 per cent criterion single subtests are quite predictive for girls, although the /l/ Cluster Subtests are not predictive for any sample, and the /r/ Cluster Subtest reaches the criterion only in Samples A-1 and A-2. All other subtests predict performance at this level for all except Sample B-II on Total Clusters and Total minus /hw/. At the 80 per cent criterion for girls, the /r/ and /l/ Cluster Subtests are not predictive for any samples. All other subtests reach this level in Samples A-1 and A-2. In the B-I sample it is reached for the Total Test minus /hw/, Total Consonants and /s/ Cluster Subtests. No subtest administered in Spring 1960 is predictive at this level.

When the 75 per cent criterion is applied to the boys in Sample A-1 all subtests except /l/ and /r/ Clusters predict satisfactorily; in Sample A-2 only Total Consonants, in Sample B-I only Total Test minus /hw/ and /s/ Clusters; and in Sample B-II Total Consonants. At the 80 per cent criterion only the Total Test minus /hw/, Total Consonants and /s/ Clusters in Sample A-1 predicted satisfactorily.

Prediction on 1962 Spencer Articulation Test

The percentage of subjects identified as needing therapy by their scores on the 1962 Spencer Articulation Test is presented for each sample in Table 6. The percentages for girls is considerably lower than for boys. While the percentages for girls are very consistent from sample to sample, the percentages for boys vary. The highest percentage of speech failures are identified in Sample B.

Table 6. Number and Per Cent of Failures Identified in Fall 1962 on Spencer Articulation Test by Sex and Sample.

	Boys Sample			Girls Sample		
	A-1	A-2	B	A-1	A-2	B
Number Failures	26	23	86	15	19	37
Number Subjects	202	209	593	282	278	586
Per Cent Failures	13	11	14.5	5	7	6

Correlations between scores on the criterion measure, 1962 Spencer Articulation Test, and each of the 1960 Articulation Subtests are consistent for Sample A-1, A-2 and B-I (Table A-23). For both boys and girls correlations of scores on Picture and Imitation Subtests are essentially in the .5 and .6 range, except that correlations on specific phoneme subtests are, for the most part, at .3 or .4.

The correlations between the 1962 criterion score and the subtests administered in Spring 1960 (Sample B-II) are, on the whole, of the same magnitude as those based on scores of tests administered six months later.

Prediction based on seventeen subtests is somewhat better for boys than for girls in Sample A-1 (Table A-24). For boys in this sample, a cut-off at 75 per cent of speech failures accurately predicts about 90 per cent of speech successes; at 80 per cent of speech failures predicts 90 per cent of speech successes; and at 85 per cent of speech failures predicts 86 per cent of speech successes. For girls in Sample A-1, when the cut-off was made to predict 75 per cent of the subjects needing speech therapy, 95 per cent of those not needing therapy were predicted accurately. Cut-offs at 80 and 85 per cent of speech failures predicted 74 and 48 per cent of speech successes.

The discriminate function coefficients for the 17 Subtests were applied only to Sample A-2. On this sample good prediction for boys held up only when the cut-off was made to predict 75 per cent of speech failures. At this level 91 per cent of speech successes were predicted (Table A-25). Cut-offs at 80 and 85 per cent of speech failures predicted 74 and 56 per cent of speech successes respectively. For girls coefficients for the 17 Subtests applied to Sample A-2 gave better prediction than was determined on Sample A-1. Cut-offs at 75, 80 and 85 per cent speech failures predict 86, 84 and 71 per cent of speech successes respectively.

Table 7. Step-wise Multiple Linear Regression Analysis. Twelve 1960 Picture and Imitation Articulation Subtests on 1962 Spencer Test for Boys and Girls, Sample A-1.

Number of Subtests	Boys Sample A-1	
	R	Deleted Subtest
12	.5523	P - /s/ Clusters
11	.5522	I - /r/ Clusters
10	.5521	I - Final Consonants
9	.5519	P - Final Consonants
8	.5517	P - Total Test
7	.5508	I - /s/ Clusters
6	.5484	P - /r/ Clusters
5	.5476	I - Total Consonants
4	.5472	I - /l/ Clusters
3	.5426	P - /l/ Clusters
2	.5404	P - Total Consonants
1	.5328	I - Total Test

Number of Subtests	Girls Sample A-1	
	R	Deleted Subtest
12	.5634	P - Final Consonants
11	.5634	I - /s/ Clusters
10	.5633	I - Total Test
9	.5632	P - Total Consonants
8	.5631	I - Final Consonants
7	.5630	P - /s/ Clusters
6	.5623	P - /l/ Clusters
5	.5605	P - Total Test
4	.5587	I - /r/ Clusters
3	.5551	P - /r/ Clusters
2	.5531	I - /l/ Clusters
1	.5414	I - Total Consonants

The results of a multiple linear regression analysis using twelve 1960 Picture and Imitation Subtests of the 1960 Articulation Test are presented in Table 7. Correlations are substantial for both girls and boys. The range in magnitude of correlation between the criterion measure and from one to twelve subtests is less than .03 for both sexes. There is no point at which deletion of a subtest made any substantial change in the magnitude of the correlation with the 1962 Spencer Articulation Test. From the last four subtests to be deleted, three were selected to be used in a discriminant analysis. The subtests selected were the same as those used with the 1962 Imitation Articulation test. For boys they are: Picture and Imitation /l/ Clusters, and Imitation Total Test. For girls they are: Imitation /l/ Clusters, Imitation /r/ Clusters and Imitation Total Consonants.

The discriminant analysis based on three variables with Sample A-1 predicted for boys about as well as that based on 17 Subtests, with cut-offs that predicted 75, 80 and 85 per cent accurately needing therapy (Table A-24). For girls in Sample A-1 there was little difference in the prediction on three or 17 subtests when the cut-off was taken to identify 75 per cent of the girls needing therapy. However, when the cut-off was at 80 or 85 per cent of the girls needing therapy, prediction was somewhat better when based upon three than when based upon 17 subtests with 83 and 52 per cent of the girls not needing therapy correctly predicted.

When the discriminant function coefficients were applied to Samples A-2 and B-I, prediction held up well for both boys and girls (See Table A-25, A-26).

Prediction over a two-and-a-half year span (Sample B-II) was about as good as over the two year span for both boys and girls when cut-offs were made at 75 and 80 per cent of speech failures (Table A-27).

For boys the prediction on three subtests for Samples A-2, B-I and B-II was determined substituting Total Test Minus /hw/ for Total Test. This substitution of the better developmental measure resulted in prediction about equal to that based on the three Subtests determined on the basis of the multiple linear regression analysis.

Table A-28 presents discriminant function coefficients and cut-off values for boys and girls in the several samples when prediction is based on three Subtests.

Some single Subtest scores predict well on the 1962 Spencer Articulation test. The /l/ and the /r/ Clusters did not predict for either boys or girls. For boys, all other Subtests accurately predicted 75 per cent of those needing and not needing therapy for Sample A-1. For boys in Samples A-2 and B-I four and six of the Subtests predict at about this level. Single Subtests do not predict satisfactorily at the 80 per cent cut-off for these samples except in a few scattered instances. For girls, all Subtests in Samples A-1, A-2 and B-I, except /s/ Clusters in Sample A-1 and A-2, predict 75 per cent of the subjects needing and not needing therapy. At the 80 per cent cut-off for Samples A-1, A-2 and B-I good predictions are scattered.

For both boys and girls Total Test minus /hw/, Total Consonants and Initial Consonants predict 75 per cent of the speech failures and successes over a two-and-a-half year span (Sample B-II). Total Clusters for boys and Final Consonants for girls also predict at this cut-off. At the 80 per cent cut-off value Total Test Minus /hw/ for the girls is the only good predictor.

Prediction on 1962 Intelligibility Rating

The percentage of subjects identified as needing therapy by their 1962 Intelligibility Ratings is presented for each sample in Table 8. In all samples a higher percentage of boys than girls is identified. The percentages for each sex are quite consistent from sample to sample, but slightly higher for Sample B.

Table 8. Number and Per Cent of Failures Identified in Fall 1962 on Intelligibility Rating by Sex and Sample.

	Boys Sample			Girls Sample		
	A-1	A-2	B	A-1	A-2	B
Number Failures	20	18	73	14	15	40
Number Subjects	202	209	593	282	278	586
Per Cent Failures	9.9	8.6	12.3	5.0	5.4	6.8

Table A-29 presents the correlations between 1962 Intelligibility Rating and scores on 1960 Picture and Imitation Subtests for boys and girls. All correlations are negative since poor intelligibility was rated _3_ and good intelligibility was rated 1. The correlations for all Subtests tend most frequently to be .2 or .3. Corelations are quite consistently low from sample to sample, except that the correlations for boys in Sample B-I range slightly higher (between .24 and .42).

A discriminant analysis carried on with 17 Subtests did not give good prediction on Intelligibility Rating (Table A-30). For boys and girls in Sample A-1, when 75 per cent of subjects needing therapy were correctly predicted, 75 per cent of those not needing therapy were also predicted. However, when the cut-off was made at 80 per cent of the speech failures, only 53 per cent of the boys and 69 per cent of the girls who were speech successes were predicted. At the 85 per cent cut-off, the percentage of the speech success acurately predicted fell to 50 and 55 per cent for boys and girls respectively.

When the discriminant function coefficients on the 17 subtests were applied to Sample A-2, poor prediction on Intelligibility Rating was reaffirmed. For both sexes when cut-offs were taken at 75, 70 and 85 per cent speech failures the percentage of speech successes correctly predicted ranged from 38 to 52 per cent for the girls, and from 57 to 69 per cent for the boys.

Because of the relatively poor prediction of 17 variables on 1962 Intelligibility Rating, prediction based on three subtests and on single subtests are not reported.

Inconsistent 1960 Articulation Scores

One hypothesis investigated was that subjects whose 1960 Picture and Imitation Articulation Test scores were dissimilar would show rapid improvement in articulation and thus, that fewer such subjects would need speech therapy in Fall 1962, when they were in the second grade, than those with consistent 1960 articulation scores. To test this hypothesis the performance of subjects from Sample B who differed .4 of a standard deviation or more between their 1960 Picture and Imitation Test scores were considered inconsistent. These subjects were one group selected for longitudinal study.

The number and percentage of subjects with consistent and inconsistent 1960 articulation scores that were identified as speech failures or speech successes, i.e. needing or not needing speech therapy, on the three 1962 criterion measures are presented in Table 9.

Table 9. Number and Per Cent of Sample B Subjects with Consistent and Inconsistent Picture and Imitation Scores Identified as Needing Speech Therapy in 1962 Criterion Measures.

	Inconsistent Scores				Consistent Scores			
	Boys		Girls		Boys		Girls	
	N	%	N	%	N	%	N	%
Imitation Test								
Speech Failures	8	34.8	5	16.7	78	13.7	32	5.8
Speech Successes	15	65.2	25	83.3	492	86.3	524	94.2
Spencer Tests								
Speech Failures	6	26.1	6	20.0	86	15.0	38	6.8
Speech Successes	17	73.9	24	80.0	484	85.0	518	93.2
Intelligibility Rating								
Speech Failures	4	17.4	5	16.7	69	12.1	35	6.3
Speech Successes	19	82.6	25	83.3	501	87.9	521	93.7

The percentage of subjects identifed as needing therapy was contrary to the hypothesis since a higher percentage of subjects with inconsistent than with consistent Picture and Imitation 1960 articulation scores was identified on the three criterion measures.

Table 10. Chi Square Values for Number of Subjects with 1960 Consistent and Inconsistent Scores Identified as Needing Speech Therapy in 1962.

	1962 Criteria Measures		
	Imitation	Spencer	Intelligibility
Boys	7.94**	2.04	0.57
Girls	5.73*	7.10**	4.81*

**p< 01
*p<.05

Chi squares calculated to determine whether the distributions of the subjects needing and not needing therapy were significantly different for subjects with consistent and inconsistent 1960 articulation scores are presented in Table 10. For girls on all criterion measures and for boys on the Imitation Articulation criterion the subjects with inconsistent scores are more frequently identified as needing speech therapy at the .01 or .05 levels of confidence.

Lack of improvement of subjects with inconsistent scores is also apparent in unpublished data from the longitudinal invesitgation of their performance (USOE Project Number 2220).

DISCUSSION

Several 1960 articulation subtests predicted 1962 articulation test results quite well, and the prediction was consistent from sample to sample. If predictors are to be put to any practical use, they should, of course, be validated. In this study the number of subjects tested at the same time was large enough so that several comparable samples were constituted on which to determine and validate prediction. Since in this study prediction was made over a two and a two-and-a-half year period, the simultaneous testing of a sufficient number of subjects to make up several samples condensed considerably the length of time required for validation. The similarity of the several samples when compared on background characteristics, performance on 1960 or 1962 articulation tests and on the magnitude of correlations between the same variables enhances the value of comparisons of the analyses carried on with them.

Unlike any of the other prediction studies reviewed, the subjects in this study were quite representative of the kindergarten population of a large city school system. They were not selected or identified on the basis of the number or the type of misarticulations measured in prekindergarten or kindergarten. Not until the terminal testing in second grade was an attempt made to characterize articulation of the subjects as deviant or nondeviant. Thus, this study was essentially developmental in its approach.

In the second grade the subjects were identified as needing or not needing therapy on the basis of their score on the criterion measures. These scores were arbitrarily selected to identify percentages of subjects needing speech therapy that would be roughly similar to those receiving therapy in the elementary schools. Conforming to actual case loads of speech clinicians in the elementary schools, the percentages of boys identified as needing speech therapy in 1960 on each of the criterion measures are higher than for girls. The percentage of girls identified as needing therapy was quite similar on all criterion measures for all samples. However, not only did the percentages of boys identified on the several criteria vary, but a somewhat higher percentage was identified in Sample B which is made up of subjects whose parents had brought them to participate in the study as prekindergartners.

Kindergarten production of specific phonemes by subjects identified as speech failures in second grade should be examined to provide information for defining an articulation deviation in prekindergarten and kindergarten on the basis of later articulation performance. Such a definition is needed since there is currently no good objective standard or description of what constitutes an articulation problem in kindergarten.

Only a small percentage of second-grade children need speech therapy. Thus, even in good prediction, the actual number of subjects who had low articulation scores in 1960 but were speech successes in

1962 may exceed the number of subjects who also had low articulation scores in 1960 but who were speech failures in 1962. So that speech assistance may be made available as early as possible, it is most important to be able to identify in kindergarten those children who will need therapy in second grade. There is no doubt, however, that much work needs to be done to delineate as many as possible of the characteristics differentiating those subjects whose kindergarten articulation performance is low, but who improve without therapy during the early school years. Only one hypothesis concerned with the relation of characteristics of articulation performance to later articulation improvement was tested in this report. However, further analyses of data from this study may give some insights into other differentiating characteristics.

The hypothesis was not supported that subjects with inconsistent 1960 Picture and Imitation Articulation Test scores would improve rapidly and not need articulation therapy in second grade. The findings were in the opposite direction, and the higher percentage of subjects with inconsistent scores identified as speech failures reached the .05 or .01 level of confidence on all three criterion measures for the girls, and the .01 level on one measure for the boys.

Studies by Carter and Buck (1958) and Snow and Milisen (1954) have found subjects with inconsistent picture and imitation articulation test scores improving more over a six-month period than those with consistent scores. It is logical to expect that children who produce sounds correctly on a repeated measure but not on a spontaneous measure should improve rapidly. Because they have demonstrated that they can articulate sounds adequately, it is expected that they will soon do so consistently.

It is difficult to compare the findings from this study with those of other investigators since much specific information on characteristics of test performance, on extent of inconsistency of scores and on analyses of the data are not reported. However, the unexpected findings may be related to differences between the samples in this and other studies. The subjects in this study differed .4 of a standard deviation between their picture and their imitation test scores. This difference is so great that it was reached by only 53 of nearly 1,200, or just over four per cent of the subjects. Neither the reports of Carter and Buck nor Snow and Milisen state the extent of deviation in the picture and imitation scores of their samples. The impression is given, however, that all subjects who shifted toward more accurate production of sounds when an aural model was presented were included. The greater the differences in scores between the picture and the imitation test the more likely that an actual shift in articulation rather than examiner error is being maximized. The selection of the sample in this study as representing the extreme shifts may account for the different results.

It is possible to explore this unexpected finding further because additional unanalyzed data are available on the present sample.

These data were gathered in eleven testing sessions as part of the longitudinal study. Examination of them suggests that, as a group, these subjects have not only improved in articulation as predicted but that they show more variability than the other groups in the longitudinal study on articulation and other measures. The question is raised as to whether it may be possible that picture and imitation articulation scores diverging as much as those considered here are associated with differences in cognitive and perceptual function and/or learning disability.

CONCLUSIONS AND IMPLICATIONS

Articulatory disorders make up the great bulk of the case loads of elementary school speech clinicians. If ways could be found to predict in prekindergarten and kindergarten those children who will later need articulation therapy, and to identify those children who might profit from therapy in kindergarten, changes would occur in the professional role of speech clinicians in the public schools and in their preparatory education. The number of articulation cases carried by speech clinicians in the early elementary grades would be reduced, and those carried would probably have more complex articulation deviations. In the education of such clinicians articulation deviation per se, and as it is associated with hearing loss, cleft palate, cerebral palsy and other disabilities would probably have a different and a more significant emphasis.

The results of this study are a promising beginning into the prediction of the need for articulation therapy at second grade based upon articulation performance two and two-and-a-half years earlier. Subtests of the 1960 Imitation articulation measure best predicted performance on the 1962 Imitation and Spencer Articulation Tests using meaningful and nonsense stimulus words respectively. They predicted 1962 Intelligibility Rating much less satisfactorily.

Seventeen, there and, in some instances, single 1960 articulation subtests predicted well on both the 1962 Imitation and Spencer Articulation Tests. The level of prediction varied somewhat for boys and girls, but it was promising for both sexes on both criteria. The relatively high level of prediction was maintained as it was validated on two additional comparable samples. Results suggest that prediction from prekindergarten to second grade on the articulation test criteria may be about as good as prediction from kindergarten to second grade.

A higher percentage of subjects with inconsistent kindergarten Picture and Imitation Articulation Test scores were speech failures in second grade than those with consistent articulation scores. This finding is contrary to those of other investigators.

Since this report is of an initial investigation that is part of a larger project much further study is indicated. The following suggestions for further analyses are based on findings reported here and in the prediction studies reviewed earlier as well as on the data available for specific analyses.

1. The articulation development of subjects with inconsistent Picture and Imitation Test scores needs to be investigated. Additional unanalyzed data on the performance of such subjects in this study is available on articulation and a number of other measures as part of the longitudinal study.

2. Criterion measures for adequate and inadequate articulation performance need to be investigated with the aim of establishing an objective criterion for use at the second or third grade level. Although in the present study a core of subjects was identified as needing therapy on each of the three 1962 criteria, some subjects were identified on only one or two of the measures. A criterion that would provide an objective standard is needed. While prediction to an articulation test is important, an ultimate goal, probably, is prediction to general articulation performance.

3. Differentiation of the characteristics of subjects with poor articulation in prekindergarten and/or kindergarten who do and do not improve in their articulation without therapy is needed. Data for comparison of the patterns of articulation and of some background factors of those subjects whose Spring or Fall 1960 articulation scores were low but who on their Fall 1962 scores were classified both as speech successes and speech failures are available for such analysis.

4. The predictive value of specific aspects of articulation (e.g. distinctive features, specific phonemes, patterns and types of phonemes) needs to be investigated. Data for such analyses are available for the subjects in this study.

5. The predictive value of factors other than articulation needs to be explored. Additional relevant data on the sample in this study includes size of family, position of subject in family, and socio-economic status. For the smaller longitudinal sample, data are also available on these and a number of other variables such as intelligence, reading, spelling, language performance, personality and from parent questionnaires.

6. Differences between the articulation development of boys and girls needs to be further investigated since the predictive value of the several subtests varies for the two sexes.

SUMMARY

Purpose

This study attempted to predict on the basis of articulation scores in kindergarten and prekindergarten those subjects who would need speech therapy at the beginning of second grade.

Sample

Subjects were 2150 children, 1004 boys and 1146 girls. Of these, 411 boys and 560 girls were tested in Fall 1960 and retested in Fall 1962. Another 593 boys and 586 girls were tested in Spring and Fall 1960 and again in Fall 1962. Subjects at the 1960 testings were drawn from 45 elementary schools and represented an essentially unselected sample of Minneapolis kindergarten children.

For purposes of analysis the subjects were subdivided into four samples as follows: Sample A-1 made up of subjects with even case numbers who were first tested in Fall 1960; Sample A-2 made up of subjects with odd case numbers who were first tested in Fall 1960; Sample B-I refers to the performance at the Fall 1960 testing of subjects who were first tested in Spring 1960; Sample B-II refers to the performance of the same subjects at the Spring 1960 testing. Subjects in Sample B differed from those in Sample A in that parents had brought the subjects before they attended kindergarten to participate in the study.

Procedure

In 1960, subjects were given a Picture Articulation Test and an Imitation Articulation Test especially constructed for the study. The two tests measured the same initial and final consonants and selected /s/, /l/, and /r/ clusters. Several initial phonemes found in a previous investigation to be uttered correctly by 75 per cent of four-year-old children were omitted. In the Picture Test the sounds were evaluated in utterances elicited in responses to a picture. In the Imitation Test the sounds were evaluated in utterances repeated after the examiner. Nine subtests made up both the Picture and Imitation Tests: Total Test, Total Test Minus /hw/, Total Consonants, Initial Consonants, Final Consonants, Total Clusters, /s/ Clusters, /l/ Clusters and /r/ Clusters. Scores on these subtests served as predictor variables.

Three criterion measures were obtained on the subjects at the second-grade testing: (1) The 1962 Imitation Articulation Test made up of all initial and final consonants (except initial /hw/) and selected clusters including /s/, /l/ and /r/. Evaluations were made of sounds as uttered in words repeated after the examiner: (2) The 1962 Spencer Articulation Test in which the consonant phonemes of English were measured in the initial and final positions in nonsense syllables; and (3) A 1962 Intelligibility Rating in which the examiner rated the subject on a three-point scale indicating much, some or no difficulty in understanding him. All testing was done in the schools by speech clinicians at the master's level, most with some public school experience.

Analysis

Subjects needing and not needing speech therapy in second grade were selected on the basis of their scores on the three 1962 criterion measures. For each criterion measure a cut-off score was determined that could be expected to identify as speech failures approximately the percentage of subjects that are receiving speech therapy in elementary schools. The same cut-off scores were used for boys and girls. Although this resulted in substantially more boys than girls being identified as needing speech therapy, the same objective standard of adequate articulation of speech sounds for boys and girls is reasonable and reflects the actual case loads of public school speech clinicians.

The predictive value of the 1960 Picture and Imitation Articulation Subtests was determined for boys and girls separately on each of the criterion measures. Discriminant analyses were carried out to predict those subjects needing speech therapy as identified on each of the criterion measures. The discriminant analysis technique does not permit the determination of levels of confidence for predictions made. To determine the goodness of Prediction, distributions were divided into:

Speech Success on 1962 Testing Speech Failure on 1960 Testing	Speech Success on 1962 Testing Speech Success on 1960 Testing
Speech Failure on 1962 Testing Speech Failure on 1960 Testing	Speech Failure on 1962 Testing Speech Success on 1960 Testing

Subjects identified as needing speech therapy in 1962 or with scores below an arbitrary cut-off in 1960 are referred to as speech failures. Subjects not needing therapy in 1962 or with scores above an arbitrary cut-off in 1960 are referred to as speech successes. On the distribution for each analysis comparisons were systematically made in which 75, 80 and 85 per cent of the subjects identified as speech failures were correctly predicted.

Prediction is referred to as good if the percentage of speech successes correctly predicted reached at least the same level as the percentage of speech failures correctly predicted. Thus, prediction at the 75 per cent cut-off was good if at least 75 per cent of subjects both needing and not needing therapy were correctly predicted; it was good at the 80 per cent cut-off if at least 80 per cent of both groups were correctly predicted, etc. and at the 85 percent cut-off if at least 85 per cent of both groups were correctly predicted.

Discriminant analyses were carried out with Sample A-1 in which seventeen subtests were used to predict those boys and girls needing speech therapy as identified on each of the criterion measures. Discriminant coefficients for the seventeen subtests were applied to Sample A-2 to validate the prediction. If the prediction using the seventeen subtests as predictors was good, a multiple linear regression analysis was carried on to determine the order in which the subtests should be deleted on the basis of their contribution to the correlation. Such an analysis was made for the Imitation and the Spencer Tests.

Three subtests were selected from the last four to be deleted in the regression analysis. The subtests retained for prediction differed for boys and girls. Those used for girls were: Imitation Total Consonants; Imitation /l/ Clusters; and Imitation /r/ Clusters. Those used for boys were: Imitation Total Test, Imitation /l/ Clusters; and Picture /l/ Clusters. In some analyses for boys the Total Test Minus /hw/ was substituted for Total Test. The same subtests were used for prediction on the Imitation and the Spencer tests. Three subtests were first used in discriminant analyses with Sample A-1. The discriminant coefficients for the three subtests were then applied to Samples A-2 and B-I to validate prediction, and to Sample B-II to determine the effect of a six-month longer time span on prediction based on the three subtests.

Lastly single 1960 Imitation Subtests were examined as predictors on the 1962 Imitation and the 1962 Spencer tests. The 1960 Imitation Subtests were used since they are highly correlated with the same 1960 Picture Subtests, and since they more consistently include all the phonemes in the measurements.

Results

1. Subjects in Samples A-1, A-2 and B-I were similar in CA, position in the family and number of children in the family so that they constitute satisfactory samples on which to determine and validate prediction. The magnitude of correlations among and between 1960 Articulation Subtests, background variables, and 1962 criterion measures are similar for the samples. The correlations for Sample B-II are also similar except in those instances noted below.

2. The percentage of girls identified by all three criteria measures as needing speech therapy in 1962 was smaller than that of boys for all samples.

3. Prediction on 1962 Imitation Articulation Test was satisfactory for both sexes, but consistently somewhat better for girls than for boys.

For both sexes: (1) Prediction based on three subtests was about equal to that based on seventeen subtests; (2) Prediction between Fall 1960 and Fall 1962 held up for all samples; (3) Prediction between Spring 1960 and Fall 1962 was nearly as good as that over the six-month shorter period; (4) Correlations between scores on the several Spring and Fall 1960 Picture and Imitation Sub ests (with the exception of the single phoneme cluster subtests) were in the .5 and .6 range.

For girls: When prediction was based on seventeen or three subtests, the optimum cut-off was that which correctly predicts 85 per cent of the speech failures. At this cut-off as many as 98 per cent of the speech successes were correctly predicted. All single 1960 Imitation Subtests with the exception of the /l/ and /r/ Cluster Subtests were good predictors when a cut-off was made so that 75 per cent of the speech failures were correctly predicted. The Total Test Minus /hw/ and Total Consonants were good predictors when the cut-off was made to correctly predict 85 per cent of the speech failures.

For boys: When prediction was based on seventeen or three subtests the optimum cut-off varied between 75 and 80 per cent of the speech failures being correctly predicted. Results were similar when the score on the Imitation Total Test Minus /hw/ was substituted for that on the Total Test as one of the three subtests used in prediction. Single 1960 Picture and Imitation Articulation Subtests were not consistently satisfactory predictors.

4. Prediction on 1962 Spencer Articulation Test was quite satisfactory for both sexes, but, in general prediction for boys surpassed that for girls.

For both sexes: (1) Prediction based on three subtests was approximately equal to that based on seventeen subtests; (2) Prediction between Fall 1960 and Fall 1962 held up for all samples; (3) Prediction between Spring 1960 and Fall 1962 was about as good as between Fall 1960 and Fall 1962 when cut-offs were made to correctly predict 75 and 80 per cent of the speech failures; (4) Some single 1960 Picture and Imitation Articulation Subtests are good predictors when 75 per cent of the speech failures are identified; (5) Correlations between the several Fall 1960 Picture and Imitation Articulation Subtests (except the specific phoneme clusters) and the 1962 Spencer Articulation Test score were in the .5 and .6 range.

For girls: When prediction was based on seventeen or three subtests the optimum cut-off was that which identified 80 per cent of the speech failures. Correlation between single Spring 1960 Picture and Articulation Subtests and the 1962 Spencer scores were slightly lower (in the .4 to .5 range) than those between Fall 1960 and Fall 1962 scores.

For boys: When prediction was based on seventeen or three subtests the optimum cut-off was that which identified 80 per cent of the speech failures.' Correlations between single Spring 1960 Picture and Imitation Articulation Subtests and the 1962 Spencer Test were similar to those between Fall 1960 and Fall 1962.

5. Prediction on the 1962 Intelligibility Rating was not satisfactory. When prediction was based on seventeen subtests, only if the cut-off was made to correctly predict 75 per cent of the speech failures was prediction good, i.e. an equal percentage (75) of speech successes was correctly predicted. This was true for boys and girls in Sample A-1. No additional discriminant analyses were carried out. Correlations between scores on the several 1960 Picture and Imitation Articulation Subtests and the 1962 Intelligibility Ratings were in the .2 to .3 range for both sexes in all samples.

6. The one hypothesis tested was that fewer subjects with inconsistent scores on the 1960 Picture and Imitation Articulation Tests would need speech therapy in 1962 than subjects with consistent scores in 1960. Scores differing .4 standard deviation were considered inconsistent. Those subjects in Sample B whose Fall 1960 Picture and Imitation Articulation Test scores differed to this extent served as subjects to test the hypothesis. It was not supported on any of the criterion measures. A higher percentage of subjects with inconsistent scores were identified as speech failures in 1962 on all criterion measures. The percentages were higher at the .05 or .01 level of confidence on all measures for girls and in the 1962 Imitation Articulation Test for boys.

Suggestions for further research

Suggestions for further research are based on findings of this and other prediction studies. Since this report presents results of an initial investigation that is part of a larger project, substantial amounts of data are available for analysis.

1. Further investigation of the articulation development of subjects with inconsistent scores on picture and imitation tests showed be carried out using articulation and other data obtained at eleven six-month intervals as part of the longitudinal aspect of the larger project.

2. Criterion measures for adequate and inadequate articulation performance need to be investigated with the aim of establishing an objective criterion for use at the second-grade or above. While prediction to an articulation test is important, an ultimate goal is prediction to general articulation performance.

3. The characteristics of articulation and background factors that differentiate subjects who although speech failures in kindergarten or prekindergarten need and do not need speech therapy in second grade need to be delineated. Some data for this investigation are available.

4. The predictive value of such specific aspects of articulation as distinctive features, specific phonemes, and types and patterns of phonemes should be investigated. Data are available.

5. The predictive value of factors other than articulation needs to be explored. Data are available on background factors, parent questionnaires and variables such as intelligence, reading, spelling, language performance and personality from the longitudinal study.

6. Differences between the articulation development of boys and girls should be further investigated since the predictive value of the subtests investigated varies for the two sexes.

Conclusion

Results of this study are sufficiently promising that further investigation into the prediction at prekindergarten or kindergarten of the need for articulation therapy two or two-and-a-half years later should be continued. Data are available as part of the larger project for a number of aspects of the problem to be further explored. If objective standards to identify those subjects who will and those who will not spontaneously improve their articulation could be established, the professional role of speech clinicians in the public school and their educational preparation would be affected.

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Table A-1. Mean Scores on Fall 1960 Picture and Imitation Articulation Subtests for Boys and Girls, Sample A-1.

	Boys (N=202)		Girls (N=282)	
	$\bar{X}$	SD	$\bar{X}$	SD
PICTURE SUBTESTS				
P-Total Test	81.03	17.05	84.81	14.26
P-Total minus /hw/	82.25	17.26	86.21	14.30
P-Total Consonants	83.23	15.65	86.98	12.90
P-Initial Consonants	79.51	20.72	85.31	16.06
P-Final Consonants	85.35	14.79	88.01	12.43
P-Total Clusters	79.51	25.33	84.51	21.57
P-/s/ Clusters	73.25	39.41	78.22	36.98
P-/l/ Clusters	81.54	29.56	88.98	22.42
P-/r/ Clusters	83.40	31.35	86.05	28.17
IMITATION SUBTESTS				
I-Total Test	84.40	17.59	88.15	14.49
I-Total minus /hw/	85.27	17.82	89.13	14.59
I-Total Consonants	86.47	16.00	89.77	13.38
I-Initial Consonants	83.26	19.84	88.16	15.63
I-Final Consonants	88.48	15.12	90.99	12.82
I-Total Clusters	81.34	26.06	87.13	20.58
I-/s/ Clusters	74.90	39.96	80.67	37.05
I-/l/ Clusters	83.93	28.43	91.58	21.42
I-/r/ Clusters	84.92	29.50	89.01	26.69

Table A-2. Mean Scores on Fall 1960 Picture and Imitation Articulation Subtests for Boys and Girls, Sample A-2.

	Boys (N=209)		Girls (N=278)	
	$\bar{X}$	SD	$\bar{X}$	SD
PICTURE SUBTESTS				
P-Total minus /hw/	84.38	17.50	85.14	15.35
P-Total Consonants	84.94	16.13	86.26	13.81
P-Initial Consonants	83.18	19.67	84.87	16.38
P-Final Consonants	86.22	15.47	87.07	13.78
P-Total Clusters	83.03	23.59	82.17	22.91
P-/s/ Clusters	79.11	35.07	75.42	37.69
P-/l/ Clusters	82.65	27.88	87.62	22.84
P-/r/ Clusters	86.28	29.08	82.95	30.90
IMITATION SUBTESTS				
I-Total Test	86.67	17.39	87.04	15.01
I-Total minus /hw/	87.47	17.48	87.96	15.10
I-Total Consonants	88.32	15.76	89.02	13.36
I-Initial Consonants	86.27	18.59	87.25	15.73
I-Final Consonants	89.75	15.20	90.23	13.03
I-Total Clusters	84.81	24.10	84.86	22.66
I-/s/ Clusters	81.58	34.09	78.15	37.23
I-/l/ Clusters	84.81	27.87	90.20	22.75
I-/r/ Clusters	87.92	27.89	86.06	28.55

Table A-3. Mean Scores on Fall 1960 Picture and Imitation Articulation Subtests for Boys and Girls, Sample B-I.

	Boys (N=593)		Girls (N=586)	
PICTURE SUBTESTS	$\bar{X}$	SD	$\bar{X}$	SD
P-Total minus /hw/	78.85	18.13	85.27	15.15
P-Total Consonants	80.83	15.91	86.34	13.29
P-Initial Consonants	77.44	19.93	84.66	16.70
P-Final Consonants	82.93	14.93	87.34	12.61
P-Total Clusters	73.57	28.06	82.43	23.18
P-/s/ Clusters	68.83	41.81	73.98	39.37
P-/l/ Clusters	75.94	34.32	89.89	20.61
P-/r/ Clusters	75.81	36.37	83.00	32.34
IMITATION SUBTESTS				
I-Total Test	80.91	18.12	87.07	15.00
I-Total minus /hw/	81.60	18.36	87.86	15.10
I-Total Consonants	83.55	16.37	89.19	13.02
I-Initial Consonants	80.67	19.65	87.56	16.13
I-Final Consonants	85.47	15.44	90.21	12.10
I-Total Clusters	75.80	27.38	83.78	23.00
I-/s/ Clusters	69.48	42.08	75.26	39.57
I-/l/ Clusters	78.63	32.88	90.78	20.87
I-/r/ Clusters	79.13	34.42	85.11	30.31

Table A-4. Mean Scores on Fall 1960 Picture and Imitation Articulation Subtests for Boys and Girls, Sample B-II.

	Boys (N=593)		Girls (N=586)	
PICTURE SUBTESTS	$\bar{X}$	SD	$\bar{X}$	SD
P-Total minus /hw/	75.42	19.41	81.94	16.64
P-Total Consonants	78.08	16.90	83.83	14.37
P-Initial Consonants	72.97	21.20	80.83	18.34
P-Final Consonants	81.73	19.57	85.56	13.67
P-Total Clusters	68.30	30.00	77.11	26.08
P-/s/ Clusters	60.82	44.19	66.79	41.11
P-/l/ Clusters	68.93	38.15	83.48	27.50
P-/r/ Clusters	75.72	36.07	80.92	33.29
IMITATION SUBTESTS				
I-Total Test	77.23	19.16	83.86	16.71
I-Total minus /hw/	77.66	19.38	84.46	16.54
I-Total Consonants	80.09	17.03	85.96	14.55
I-Initial Consonants	75.26	21.05	83.34	18.07
I-Final Consonants	83.25	16.02	87.84	13.72
I-Total Clusters	70.45	29.68	79.74	25.16
I-/s/ Clusters	63.36	43.43	68.76	41.42
I-/l/ Clusters	70.87	36.98	86.62	26.02
I-/r/ Clusters	77.11	35.20	83.55	31.28

Table A-5. Intercorrelations of Scores on Fall 1960 Picture Articulation Subtests for Boys and Girls, Sample A-1.

BOYS (N = 202)		Picture Subtests							
		P2	P3	P4	P5	P6	P7	P8	P9
P1	Total Test	.998	.970	.904	.900	.916	.718	.725	.664
P2	Total minus /hw/		.972	.906	.903	.919	.723	.727	.662
P3	Total Consonants			.924	.945	.814	.642	.660	.588
P4	Initial Consonants				.758	.779	.603	.646	.543
P5	Final Consonants					.743	.593	.597	.552
P6	Total Clusters						.777	.763	.733
P7	/s/ Clusters							.351	.319
P8	/l/ Clusters								.452
P9	/r/ Clusters								
GIRLS (N = 282)									
P1	Total Test	.997	.955	.884	.899	.886	.685	.684	.603
P2	Total minus /hw/		.956	.886	.899	.890	.692	.685	.600
P3	Total Consonants			.914	.950	.721	.563	.589	.457
P4	Initial Consonants				.743	.692	.532	.588	.425
P5	Final Consonants					.661	.517	.527	.433
P6	Total Clusters						.781	.717	.711
P7	/s/ Clusters							.310	.241
P8	/l/ Clusters								.433
P9	/r/ Clusters								

Table A-6. Intercorrelations of Scores on Fall 1960 Imitation Articulation Subtests for Boys and Girls, Sample A-1.

BOYS (N = 202)		Imitation Subtests							
		I2	I3	I4	I5	I6	I7	I8	I9
I1	Total Test	.998	.967	.934	.931	.939	.776	.759	.714
I2	Total minus /hw/		.978	.937	.933	.941	.781	.757	.716
I3	Total Consonants			.954	.965	.861	.710	.706	.652
I4	Initial Consonants				.850	.838	.673	.700	.649
I5	Final Consonants					.816	.683	.667	.612
I6	Total Clusters						.831	.789	.774
I7	/s/ Clusters							.459	.413
I8	/l/ Clusters								.518
I9	/r/ Clusters								
GIRLS (N = 282)									
I1	Total Test	.997	.973	.934	.940	.906	.686	.674	.602
I2	Total minus /hw/		.974	.936	.940	.911	.692	.675	.606
I3	Total Consonants			.951	.973	.796	.590	.620	.524
I4	Initial Consonants				.857	.781	.583	.617	.501
I5	Final Consonants					.754	.554	.585	.508
I6	Total Clusters						.789	.674	.677
I7	/s/ Clusters							.292	.204
I8	/l/ Clusters								.350
I9	/r/ Clusters								

Table A-7. Intercorrelations of Scores on Fall 1960 Picture Articulation Subtests for Boys and Girls, Sample A-2.

		Picture Subtests						
BOYS (N = 209)		P2	P3	P4	P5	P6	P7	P8
P1	Total minus /hw/	.979	.920	.924	.909	.704	.732	.730
P2	Total Consonants		.923	.957	.815	.640	.655	.654
P3	Initial Consonants			.778	.780	.613	.677	.608
P4	Final Consonants				.755	.589	.571	.618
P5	Total Clusters					.731	.753	.804
P6	/s/ Clusters						.323	.338
P7	/l/ Clusters							.579
P8	/r/ Clusters							
GIRLS (N = 278)								
P1	Total minus /hw/	.966	.896	.917	.903	.690	.728	.642
P2	Total Consonants		.913	.957	.763	.567	.656	.532
P3	Initial Consonants			.760	.735	.547	.610	.527
P4	Final Consonants				.708	.531	.617	.482
P5	Total Clusters					.784	.739	.735
P6	/s/ Clusters						.342	.269
P7	/l/ Clusters							.491
P8	/r/ Clusters							

Table A-8. Intercorrelations of Scores on Fall 1960 Imitation Articulation Subtests for Boys and Girls, Sample A-2.

		Imitation Subtests							
BOYS (N = 209)		I2	I3	I4	I5	I6	I7	I8	I9
I1	Total Test	.998	.984	.941	.935	.942	.735	.792	.752
I2	Total minus /hw/		.984	.943	.935	.945	.741	.792	.753
I3	Total Consonants			.936	.964	.874	.683	.744	.687
I4	Initial Consonants				.811	.875	.696	.753	.665
I5	Final Consonants					.802	.617	.677	.648
I6	Total Clusters						.790	.815	.811
I7	/s/ Clusters							.417	.408
I8	/l/ Clusters								.602
I9	/r/ Clusters								
GIRLS (N = 278)									
I1	Total Test	.997	.972	.923	.931	.669	.695	.758	.668
I2	Total minus /hw/		.972	.923	.932	.919	.701	.759	.670
I3	Total Consonants			.939	.967	.803	.601	.694	.576
I4	Initial Consonants				.821	.780	.549	.698	.585
I5	Final Consonants					.756	.585	.643	.524
I6	Total Clusters						.785	.767	.746
I7	/s/ Clusters							.376	.265
I8	/l/ Clusters								.537
I9	/r/ Clusters								

Table A-9. Intercorrelations of Scores on Fall 1960 Picture Articulation Subtests for Boys and Girls, Sample B-I.

	Picture Subtests						
BOYS (N = 593)	P2	P3	P4	P5	P6	P7	P8
P1 Total minus /hw/	.964	.908	.918	.911	.688	.705	.641
P2 Total Consonants		.932	.954	.774	.595	.608	.522
P3 Initial Consonants			.796	.738	.544	.587	.519
P4 Final Consonants				.729	.573	.573	.478
P5 Total Clusters					.745	.755	.736
P6 /s/ Clusters						.323	.272
P7 /l/ Clusters							.417
P8 /r/ Clusters							
GIRLS (N = 580)							
P1 Total minus /hw/	.970	.901	.917	.926	.723	.668	.701
P2 Total Consonants		.923	.950	.810	.626	.605	.607
P3 Initial Consonants			.758	.759	.583	.544	.587
P4 Final Consonants				.760	.589	.590	.557
P5 Total Clusters					.787	.689	.765
P6 /s/ Clusters						.302	.300
P7 /l/ Clusters							.472
P8 /r/ Clusters							

Table A-10. Intercorrelations of Scores on Fall 1960 Imitation Articulation Subtests for Boys and Girls, Sample B-I.

	Imitation Subtests							
BOYS (N = 593)	I2	I3	I4	I5	I6	I7	I8	I9
I1 Total Test	.998	.972	.929	.939	.915	.708	.729	.620
I2 Total minus /hw/		.973	.930	.939	.918	.713	.728	.623
I3 Total Consonants			.951	.970	.802	.629	.657	.518
I4 Initial Consonants				.847	.776	.591	.640	.516
I5 Final Consonants					.767	.612	.626	.484
I6 Total Clusters						.768	.755	.723
I7 /s/ Clusters							.355	.270
I8 /l/ Clusters								.412
I9 /r/ Clusters								
GIRLS (N = 580)								
I1 Total Test	.997	.976	.912	.940	.726	.736	.720	.676
I2 Total minus /hw/		.977	.913	.941	.940	.739	.718	.683
I3 Total Consonants			.929	.968	.846	.656	.685	.602
I4 Initial Consonants				.825	.800	.624	.627	.579
I5 Final Consonants					.806	.617	.675	.569
I6 Total Clusters						.806	.698	.747
I7 /s/ Clusters							.340	.298
I8 /l/ Clusters								.459
I9 /r/ Clusters								

Table A-11. Intercorrelations of Scores on Spring 1960 Picture Articulation Subtests for Boys and Girls, Sample B-II.

	Picture Subtests						
	P2	P3	P4	P5	P6	P7	P8
BOYS (N = 593)							
P1 Total minus /hw/	.965	.891	.682	.920	.676	.744	.642
P2 Total Consonants		.914	.714	.792	.596	.659	.539
P3 Initial Consonants			.554	.742	.552	.630	.499
P4 Final Consonants				.551	.427	.452	.366
P5 Total Clusters					.762	.785	.711
P6 /s/ Clusters						.360	.288
P7 /l/ Clusters							.423
P8 /r/ Clusters							
GIRLS (N = 580)							
P1 Total minus /hw/	.959	.890	.912	.918	.689	.741	.691
P2 Total Consonants		.916	.942	.774	.575	.633	.591
P3 Initial Consonants			.747	.726	.529	.598	.571
P4 Final Consonants				.735	.544	.607	.553
P5 Total Clusters					.767	.788	.737
P6 /s/ Clusters						.372	.257
P7 /l/ Clusters							.539
P8 /r/ Clusters							

Table A-12. Intercorrelations of Scores on Spring 1960 Imitation Articulation Subtests for Boys and Girls, Sample B-II.

	Imitation Subtests							
	I2	I3	I4	I5	I6	I7	I8	I9
BOYS (N = 593)								
I1 Total Test	.998	.969	.919	.924	.918	.715	.755	.642
I2 Total minus /hw/		.971	.922	.925	.918	.720	.753	.640
I3 Total Consonants			.940	.961	.798	.621	.670	.548
I4 Initial Consonants				.809	.772	.591	.647	.542
I5 Final Consonants					.748	.589	.628	.505
I6 Total Clusters						.786	.796	.711
I7 /s/ Clusters							.439	.295
I8 /l/ Clusters								.411
I9 /r/ Clusters								
GIRLS (N = 580)								
I1 Total Test	.987	.956	.902	.914	.911	.704	.717	.678
I2 Total minus /hw/		.968	.911	.926	.923	.720	.717	.676
I3 Total Consonants			.930	.953	.804	.620	.649	.576
I4 Initial Consonants				.788	.763	.573	.620	.565
I5 Final Consonants					.764	.600	.612	.534
I6 Total Clusters						.788	.740	.755
I7 /s/ Clusters							.340	.301
I8 /l/ Clusters								.513
I9 /r/ Clusters								

Table A-13. Correlations between Fall 1960 CA, Position and Number of Children in Family and Scores on Fall 1960 Picture and Imitation Articulation Subtests for Boys and Girls, Sample A-1.

	Boys (N=202)			Girls (N=282)		
PICTURE SUBTESTS	CA	Position	#Children	CA	Position	#Children
P-Total Test	.01	-.13	-.16	.08	-.16	-.16
P-Total minus /hw/	.01	-.13	-.15	.08	-.16	-.15
P-Total Consonants	.01	-.11	-.16	.08	-.14	-.13
P-Initial Consonants	.03	-.13	-.17	.10	-.10	-.10
P-Final Consonants	-.02	-.08	-.11	.06	-.15	-.14
P-Total Clusters	.02	-.14	-.12	.06	-.17	-.16
P-/s/ Clusters	-.02	-.03	-.04	.01	-.10	-.10
P-/1/ Clusters	.08	-.11	-.10	.05	-.14	-.11
P-/r/ Clusters	.02	-.21	-.17	.08	-.16	-.16
IMITATION SUBTESTS						
I-Total Test	.01	-.17	-.17	.06	-.16	-.16
I-Total minus /hw/	.00	-.16	-.17	.06	-.15	-.16
I-Total Consonants	.01	-.14	-.16	.06	-.14	-.14
I-Initial Consonants	.04	-.14	-.17	.07	-.08	-.09
I-Final Consonants	-.01	-.12	-.13	.04	-.17	-.16
I-Total Clusters	-.01	-.18	-.14	.06	-.16	-.17
I-/s/ Clusters	-.00	-.10	-.09	.00	-.06	-.07
I-/s/ Clusters	-.03	-.14	-.10	.07	-.12	-.12
I-/r/ Clusters	.01	-.20	-.14	.08	-.18	-.19

Table A-14. Correlations between Fall 1960 CA, Position and Number of Children in Family and Scores on Fall 1960 Picture and Imitation Articulation Subtests for Boys and Girls, Sample A-2.

	Boys (N=209)			Girls (N=278)		
PICTURE SUBTESTS	CA	Position	#Children	CA	Position	#Children
P-Total minus /hw/	.03	-.09	-.19	-.04	-.10	-.15
P-Total Consonants	.01	-.13	-.24	-.07	-.08	-.14
P-Initial Consonants	.10	-.08	-.19	-.05	-.09	-.12
P-Final Consonants	.06	-.16	-.26	-.07	-.07	-.14
P-Total Clusters	.06	-.04	-.09	.02	-.12	-.14
P-/s/ Clusters	-.01	-.10	-.13	.01	-.06	-.07
P-/1/ Clusters	.10	-.05	-.01	-.03	-.03	-.05
P-/r/ Clusters	.07	-.01	-.02	.06	-.17	-.21
IMITATION SUBTESTS						
I-Total Test	.04	-.09	-.19	-.03	-.08	-.13
I-Total minus /hw/	.04	-.09	-.19	-.03	-.08	-.13
I-Total Consonants	.01	-.11	-.23	-.05	-.06	-.13
I-Initial Consonants	.10	-.07	-.17	-.01	-.03	-.09
I-Final Consonants	-.05	-.14	-.25	-.07	-.08	-.14
I-Total Clusters	.09	-.04	-.10	-.00	-.10	-.13
I-/s/ Clusters	.05	.11	-.17	.02	-.08	-.10
I-/1/ Clusters	.09	.07	-.02	-.06	-.01	-.03
I-/r/ Clusters	.09	-.04	-.05	.03	-.13	-.16

Table A-15. Correlations between Fall 1960 CA, Position and Number of Children in Family and Scores on Fall 1960 Picture and Imitation Articulation Subtests for Boys and Girls, Sample B-I.

	Boys (N=593)			Girls (N=580)		
PICTURE SUBTESTS	CA	Position	#Children	CA	Position	#Children
P-Total minus /hw/	.04	-.06	-.17	.19	-.12	-.24
P-Total Consonants	.07	-.04	-.15	.19	-.14	-.24
P-Initial Consonants	.08	-.05	-.15	.17	-.11	-.21
P-Final Consonants	.06	-.05	-.15	.19	-.14	-.24
P-Total Clusters	-.01	-.06	-.18	.16	-.10	-.22
P-/s/ Clusters	.00	-.09	-.18	.10	-.10	-.17
P-/l/ Clusters	.02	.02	-.08	.11	-.06	-.19
P-/r/ Clusters	-.05	-.07	-.14	.15	-.05	-.15
IMITATION SUBTESTS						
I-Total Test	.04	-.05	-.16	.18	-.11	-.22
I-Total minus /hw/	.04	-.04	-.16	.18	-.11	-.22
I-Total Consonants	-.05	-.02	-.13	.18	-.11	-.22
I-Initial Consonants	.05	-.03	-.13	.15	-.10	-.20
I-Final Consonants	.04	-.02	-.12	.18	-.11	-.21
I-Total Clusters	.01	-.07	-.19	.15	-.09	-.20
I-/s/ Clusters	.01	-.08	-.18	.12	-.10	-.18
I-/l/ Clusters	.05	.02	-.07	.09	-.04	-.16
I-/r/ Clusters	-.03	-.10	-.16	.14	-.05	-.13

Table A-16. Correlations between Fall 1960 CA, Position and Number of Children in Family and Scores on Spring 1960 Picture and Imitation Articulation Subtests for Boys and Girls, Sample B-II.

	Boys (N=593)			Girls (N=580)		
PICTURE SUBTESTS	CA	Position	#Children	CA	Position	#Children
P-Total minus /hw/	.06	-.06	-.18	.17	-.10	-.21
P-Total Consonants	.09	-.06	-.18	.18	-.11	-.21
P-Initial Consonants	.11	-.05	-.16	.16	-.10	-.20
P-Final Consonants	.06	-.01	-.11	.17	-.10	-.19
P-Total Clusters	.02	-.05	-.14	.15	-.08	-.19
P-/s/ Clusters	.00	-.08	-.12	.08	-.06	-.13
P-/l/ Clusters	.03	.04	-.06	.17	-.07	-.18
P-/r/ Clusters	.00	-.07	-.14	.10	-.05	-.15
IMITATION SUBTESTS						
I-Total Test	.06	-.04	-.16	.22	-.10	-.21
I-Total minus /hw/	.06	-.04	-.17	.22	-.11	-.23
I-Total Consonants	.08	-.04	-.17	.22	-.11	-.23
I-Initial Consonants	.12	-.01	-.14	.21	-.10	-.22
I-Final Consonants	.05	-.05	-.18	.22	-.10	-.22
I-Total Clusters	.03	-.03	-.14	.18	-.10	-.20
I-/s/ Clusters	.03	-.05	-.14	.13	-.09	-.14
I-/l/ Clusters	.03	.05	-.06	.13	-.09	-.18
I-/r/ Clusters	.06	-.01	-.08	.15	-.06	-.15

Table A-17. Correlations between Fall 1962 Articulation Test and 1960 Picture and Imitation Articulation Subtests for Boys and Girls by Sample.

	Boys				Girls			
Samples :	A-1	A-2	B-I	B-II	A-1	A-2	B-I	B-II
N :	202	209	593	593	282	278	586	586
Testing Date:	F60	F60	F60	S60	F60	F60	F60	S60
PICTURE TEST								
P-Total Test	.58	-	-	-	.56	-	-	-
P-Total minus /hw/	.58	.55	.65	.58	.56	.57	.56	.49
P-Total Consonants	.56	.54	.63	.56	.54	.55	.53	.45
P-Initial Consonants	.53	.46	.58	.51	.48	.51	.50	.42
P-Final Consonants	.49	.55	.60	.38	.52	.52	.50	.43
P-Total Clusters	.55	.52	.59	.53	.51	.50	.54	.49
P-/s/ Clusters	.47	.34	.51	.46	.42	.38	.54	.48
P-/l/ Clusters	.38	.43	.41	.38	.34	.41	.31	.33
P-/r/ Clusters	.37	.43	.37	.36	.35	.34	.31	.30
IMITATION TEST								
I-Total Test	.59	.56	.65	.59	.59	.58	.56	.51
I-Total minus /hw/	.59	.56	.65	.60	.59	.58	.56	.51
I-Total Consonants	.57	.56	.64	.58	.59	.55	.53	.48
I-Initial Consonants	.52	.50	.59	.54	.57	.52	.49	.47
I-Final Consonants	.54	.56	.64	.56	.57	.52	.51	.44
I-Total Clusters	.56	.51	.59	.54	.53	.57	.56	.49
I-/s/ Clusters	.48	.36	.53	.48	.45	.42	.55	.47
I-/l/ Clusters	.38	.42	.43	.40	.32	.49	.34	.31
I-/r/ Clusters	.45	.46	.35	.37	.34	.41	.34	.30

Table A-18. Distributions of Predictions on 1962 Imitation Articulation Test with 75 and 80 Per Cent of Failures Correctly Identified. 17, 3 and Single 1960 Imitation Subtests as Predictors. Boys and Girls, Sample A-1.

	75 PER CENT OF FAILURES								80 PER CENT OF FAILURES							
	Distribution by Number				Distribution by Per Cent				Distribution by Number				Distribution by Per Cent			
	F'62 F'60	F'62 S'60	S'62 F'60	S'62 S'60	F'62 F'60	F'62 S'60	S'62 F'60	S'62 S'60	F'62 F'60	F'62 S'60	S'62 F'60	S'62 S'60	F'62 F'60	F'62 S'60	S'62 F'60	S'62 S'60
BOYS																
17 Subtests	16	5	18	163	76	24	10	90	17	4	24	157	81	19	13	87
3 Subtests	17	4	20	161	81	19	11	89	17	4	23	158	81	19	13	87
Total minus /hw/	16	5	22	159	76	24	12	88	17	4	26	155	81	19	14	86
Total Consonants	16	5	22	159	76	24	12	88	17	4	37	144	81	19	20	80
Initial Consonants	16	5	28	153	76	24	15	85	19	2	40	141	90	10	22	78
Final Consonants	17	4	44	137	81	19	24	76	17	4	44	137	81	19	24	76
Total Clusters	16	5	21	155	76	24	14	86	17	4	38	138	81	19	24	76
/s/ Clusters	18	3	37	144	86	14	20	80	18	3	37	144	86	14	20	80
/1/ Clusters	@ -	-	-	-	-	-	-	-	@ -	-	-	-	-	-	-	-
/r/ Clusters	@ -	-	-	-	-	-	-	-	@ -	-	-	-	-	-	-	-
GIRLS																
17 Subtests	10	4	3	265	71	29	1	99	11	3	3	265	79	21	1	99
3 Subtests	10	4	5	262	71	29	2	98	11	3	8	260	79	21	3	97
Total minus /hw/	11	3	15	253	79	21	6	94	11	3	15	253	79	21	6	94
Total Consonants	11	3	14	254	79	21	5	95	11	3	14	254	79	21	5	95
Initial Consonants	11	3	13	255	79	21	5	95	11	3	13	255	79	21	5	95
Final Consonants	11	3	24	244	79	21	9	91	11	3	24	244	79	21	9	91
Total Clusters	13	1	51	217	93	7	9	91	13	1	51	217	93	7	19	81
/s/ Clusters	10	4	34	234	71	29	13	87	12	2	45	223	86	14	17	83
/1/ Clusters	@ -	-	-	-	-	-	-	-	@ -	-	-	-	-	-	-	-
/r/ Clusters	10	4	41	226	71	29	15	85	@ -	-	-	-	-	-	-	-

@ Entire sample included at cut-off

Table A-18 Continued.

85 PER CENT OF FAILURES-

	Distribution by Number				Distribution by Per Cent			
	F'62 F'60	F'62 S'60	S'62 F'60	S'62 S'60	F'62 F'60	F'62 S'60	S'62 F'60	S'62 S'60
BOYS								
17 Subtests	18	3	35	147	86	14	19	81
3 Subtests	18	3	31	151	86	14	17	83
Total Test minus /hw/	18	3	26	156	86	14	14	86
Total Consonants	19	2	50	132	90	10	27	73
Initial Consonants	19	2	41	141	90	10	23	77
Final Consonants	19	2	68	114	90	10	37	63
Total Clusters	18	3	38	144	86	14	21	79
/s/ Clusters	18	3	37	145	86	14	20	80
/l/ Clusters	@ -	-	-	-	-	-	-	-
/r/ Clusters	@ -	-	-	-	-	-	-	-
GIRLS								
17 Subtests	12	2	5	262	86	14	2	98
3 Subtests	12	2	21	246	86	14	8	92
Total Test minus /hw/	12	2	19	248	86	14	7	93
Total Consonants	12	2	27	240	86	14	10	90
Initial Consonants	13	1	29	238	93	7	11	89
Final Consonants	12	2	37	230	86	14	14	86
Total Clusters	13	1	51	216	93	7	19	81
/s/ Clusters	12	2	45	222	86	14	17	83
/l/ Clusters	-	-	-	-	-	-	-	-
/r/ Clusters	-	-	-	-	-	-	-	-

@ Entire sample included at cut-off.

Table A-19. Distributions of Predictions on 1962 Imitation Articulation Test with 75 and 80 Per Cent of Failures Correctly Identified. 17, 3 and Single 1960 Imitation Subtests as Predictors. Boys and Girls, Sample A-2.

	75 PER CENT OF FAILURES								80 PER CENT OF FAILURES							
	Distribution by Number				Distribution by Per Cent				Distribution by Number				Distribution by Per Cent			
	F'62 F'60	F'62 S'60	S'62 F'60	S'62 S'60	F'62 F'60	F'62 S'60	S'62 F'60	S'62 S'60	F'62 F'60	F'62 S'60	S'62 F'60	S'62 S'60	F'62 F'60	F'62 S'60	S'62 F'60	S'62 S'60
BOYS																
17 Subtests	16	6	59	128	73	27	32	68	18	4	90	97	82	18	48	52
3 Subtests	16	6	49	138	73	27	26	74	18	4	67	120	82	18	36	64
# 3 Subtests	16	6	54	133	73	27	29	71	18	4	59	128	82	18	32	68
Total minus /hw/	17	5	66	121	77	23	35	65	18	4	74	113	82	18	40	60
Total Consonants	16	6	45	142	73	27	24	76	18	4	71	116	82	18	40	60
Initial Consonants	18	4	61	126	82	18	33	67	18	4	61	126	82	18	40	60
Final Consonants	17	5	67	120	77	23	36	64	20	2	111	76	91	9	59	41
Total Clusters	16	6	87	100	73	27	47	53	@ -	-	-	-	-	-	-	-
/s/ Clusters	@ -	-	-	-	-	-	-	-	@ -	-	-	-	-	-	-	-
/l/ Clusters	@ -	-	-	-	-	-	-	-	@ -	-	-	-	-	-	-	-
/r/ Clusters	@ -	-	-	-	-	-	-	-	@ -	-	-	-	-	-	-	-
GIRLS																
17 Subtests	12	4	32	231	75	25	12	88	13	3	41	222	81	19	16	84
3 Subtests	12	4	24	239	75	25	9	91	13	3	26	237	81	19	10	90
Total minus /hw/	12	4	21	242	75	25	8	92	14	2	25	238	88	12	10	90
Total Consonants	12	4	24	239	75	25	9	91	13	3	31	232	81	19	12	88
Initial Consonants	13	3	32	231	81	19	12	88	13	3	32	231	81	19	12	88
Final Consonants	12	4	19	244	75	25	7	93	13	3	27	236	81	19	10	90
Total Clusters	12	4	15	248	75	25	6	94	14	2	28	235	88	12	11	89
/s/ Clusters	13	3	44	219	81	19	17	83	13	3	44	219	81	19	17	83
/l/ Clusters	@ -	-	-	-	-	-	-	-	@ -	-	-	-	-	-	-	-
/r/ Clusters	12	4	55	208	75	25	21	79	@ -	-	-	-	-	-	-	-

@ Entire sample included at cut-off.

Total Test minus /hw/ substituted for Total Test.

Table A-19 Continued.

85 PER CENT OF FAILURES

	Distribution by Number				Distribution by Per Cent			
	F'62 F'60	F"62 S'60	S'62 F'60	S'62 S'60	F'62 F'60	F'62 S'60	S'62 F'60	S'62 S'60
BOYS								
17 Subtests	19	3	125	61	86	14	67	33
# 3 Subtests	19	3	80	106	86	14	43	57
3 Subtests	19	3	93	93	86	14	50	50
Total Test minus /hw/	19	3	85	101	86	14	46	54
Total Consonants	19	3	71	109	86	14	38	62
Initial Consonants	19	3	106	80	86	14	57	43
Final Consonants	20	2	111	75	91	9	60	40
Total Clusters	@ -	-	-	-	-	-	-	-
/s/ Clusters	@ -	-	-	-	-	-	-	-
/1/ Clusters	@ -	-	-	-	-	-	-	-
/r/ Clusters	@ -	-	-	-	-	-	-	-
GIRLS								
17 Subtests	14	2	56	206	88	12	21	79
3 Subtests	14	2	28	234	88	12	11	89
Total Test minus /hw/	14	2	25	237	88	12	10	90
Total Consonants	15	1	33	229	94	6	13	87
Initial Consonants	14	2	51	211	88	12	19	81
Final Consonants	16	0	62	200	100	0	24	76
Total Clusters	14	2	46	216	88	12	18	82
/s/ Clusters	@ -	-	-	-	-	-	-	-
/1/ Clusters	@ -	-	-	-	-	-	-	-
/r/ Clusters	@ -	-	-	-	-	-	-	-

@ Entire sample included at cut-off.

# Total Test minus /hw/ substituted for Total Test.

Table A-20. Distributions of Predictions on 1962 Imitation Articulation Test with 75 and 80 Per Cent of Failures Correctly Identified. 3 and Single 1960 Imitation Subtests as Predictors. Boys and Girls, Sample B-I.

		Distribution by Number				Distribution by Per Cent			
	75 PER CENT OF FAILURES	F'62 F'60	F'62 S'60	S'62 F'60	S'62 S'60	F'62 F'60	F'62 S'60	S'62 F'60	S'62 S'60
	BOYS								
	3 Subtests	69	23	113	338	75	25	23	77
#	3 Subtests	69	23	105	415	75	25	17	83
	Total minus /hw/	70	22	121	380	76	24	24	76
	Total Consonants	71	21	133	368	77	23	27	73
	Initial Consonants	71	21	139	362	77	23	28	72
	Final Consonants	81	11	183	318	88	12	37	63
	Total Clusters	78	14	160	341	85	15	32	68
	/s/ Clusters	71	21	121	380	77	23	24	76
	/l/ Clusters @	-	-	-	-	-	-	-	-
	/r/ Clusters @	-	-	-	-	-	-	-	-
	GIRLS								
	3 Subtests	33	11	86	456	76	24	16	84
	Total minus /hw/	33	11	64	478	75	25	12	88
	Total Consonants	33	11	81	461	75	25	15	85
	Initial Consonants	34	10	100	442	77	23	18	82
	Final Consonants	34	10	85	457	77	23	16	84
	Total Clusters	41	3	120	422	93	7	22	78
	/s/ Clusters	37	7	93	449	84	16	17	83
	/l/ Clusters @	-	-	-	-	-	-	-	-
	/r/ Clusters @	-	-	-	-	-	-	-	-
	80 PER CENT OF FAILURES								
	BOYS								
	3 Subtests	74	18	123	378	80	20	25	75
#	3 Subtests	74	18	122	379	80	20	24	76
	Total minus /hw/	74	18	135	366	80	20	27	73
	Total Consonants	79	13	153	348	86	14	31	69
	Initial Consonants	76	16	159	342	83	17	32	68
	Final Consonants	81	11	183	318	88	12	37	63
	Total Clusters	78	14	160	341	85	15	32	68
	/s/ Clusters	77	15	157	344	84	16	31	69
	/l/ Clusters @	-	-	-	-	-	-	-	-
	/r/ Clusters @	-	-	-	-	-	-	-	-
	GIRLS								
	3 Subtests	35	9	88	454	80	20	16	84
	Total minus /hw/	36	8	74	468	82	18	14	86
	Total Consonants	36	8	98	444	82	18	18	82
	Initial Consonants	41	3	182	360	93	7	34	66
	Final Consonants	39	5	127	415	89	11	23	77
	Total Clusters	41	3	120	420	93	7	23	77
	/s/ Clusters	37	7	93	449	84	16	17	83
	/l/ Clusters @	-	-	-	-	-	-	-	-
	/r/ Clusters @	-	-	-	-	-	-	-	-

@ Entire sample included at cut-off.

# Total Test minus /hw/ substituted for Total Test.

Table A-20 Continued.

85 PER CENT OF FAILURES		Distribution by Number				Distribution by Per Cent			
		F'62 F'60	F'62 S'60	S'62 F'60	S'62 S'60	F'62 F'60	F'62 S'60	S'62 F'60	S'62 S'60
BOYS									
3 Subtests		79	13	166	335	86	14	33	67
# 3 Subtests		81	11	173	328	88	12	35	65
Total Test minus /hw/		79	13	159	342	86	14	32	68
Total Consonants		79	13	153	348	86	14	31	69
Initial Consonants		85	7	235	266	92	8	47	53
Final Consonants		81	11	183	318	88	12	37	63
Total Clusters		80	12	185	316	87	13	37	63
/s/ Clusters	@	-	-	-	-	-	-	-	-
/l/ Clusters	@	-	-	-	-	-	-	-	-
/r/ Clusters	@	-	-	-	-	-	-	-	-
GIRLS									
3 Subtests		38	6	113	429	86	14	21	79
Total Test minus /hw/		39	5	84	458	89	11	15	85
Total Consonants		40	4	124	418	91	9	23	77
Initial Consonants		41	3	182	360	93	7	34	66
Final Consonants		39	5	127	415	89	11	23	77
Total Clusters		41	3	120	422	93	7	22	78
/s/ Clusters		41	3	147	395	93	7	27	73
/l/ Clusters	@	-	-	-	-	-	-	-	-
/r/ Clusters	@	-	-	-	-	-	-	-	-

@ Entire sample included at cut-off.

# Total Test minus /hw/ substituted for Total Test.

Table A-21. Distributions of Predictions on 1962 Imitation Articulation Test with 75 and 80 Per Cent of Failures Correctly Identified. 3 and Single 1960 Imitation Subtests as Predictors. Boys and Girls, Sample B-II.

	Distribution by Number				Distribution by Per Cent			
75 PER CENT OF FAILURES	F'62 F'60	F'62 S'60	S'62 F'60	S'62 S'60	F'62 F'60	F'62 S'60	S'62 F'60	S'62 S'60
BOYS								
3 Subtests	69	23	116	385	75	25	23	77
# 3 Subtests	69	23	113	388	75	25	23	77
Total Test minus /hw/	73	19	131	370	79	21	26	74
Total Consonants	69	23	122	379	75	25	24	76
Initial Consonants	75	17	161	340	82	18	32	68
Final Consonants	72	20	165	336	78	22	33	67
Total Clusters	77	15	181	320	84	16	36	64
/s/ Clusters	69	23	131	370	75	25	26	74
/l/ Clusters	74	18	202	299	80	20	40	60
/r/ Clusters @	-	-	-	-	-	-	-	-
GIRLS								
3 Subtests	33	11	136	406	75	25	25	75
Total Test minus /hw/	33	11	102	340	75	25	37	63
Total Consonants	33	11	124	418	75	25	23	77
Initial Consonants	34	10	118	424	77	23	22	78
Final Consonants	33	11	126	416	75	25	23	77
Total Clusters	40	4	151	391	91	9	28	72
/s/ Clusters	33	11	94	448	75	25	17	83
/l/ Clusters @	-	-	-	-	-	-	-	-
/r/ Clusters @	-	-	-	-	-	-	-	-
80 PER CENT OF FAILURES								
BOYS								
3 Subtests	74	18	130	371	80	20	26	74
# 3 Subtests	74	18	131	370	80	20	26	74
Total Test minus /hw/	75	17	147	354	82	18	29	71
Total Consonants	78	14	169	332	85	15	34	66
Initial Consonants	75	17	161	340	82	18	32	68
Final Consonants	83	9	231	270	90	10	46	54
Total Clusters	77	15	181	320	84	16	36	64
/s/ Clusters	76	16	211	290	83	17	42	58
/l/ Clusters	74	18	202	299	80	20	40	60
/r/ Clusters @	-	-	-	-	-	-	-	-
GIRLS								
3 Subtests	35	9	148	394	80	20	27	73
Total Test minus /hw/	35	9	154	388	80	20	28	72
Total Consonants	37	7	184	358	84	16	34	66
Initial Consonants	42	2	255	287	95	5	47	53
Final Consonants	39	5	206	336	89	11	38	62
Total Clusters	40	4	151	391	91	9	28	72
/s/ Clusters	37	7	123	419	84	16	23	77
/l/ Clusters @	-	-	-	-	-	-	-	-
/r/ Clusters @	-	-	-	-	-	-	-	-

@ Entire sample included at cut-off.

# Total Test minus /hw/ substituted for Total Test.

Table A-21 Continued.

85 PER CENT OF FAILURES	Distribution by Number				Distribution by Per Cent			
	F'62 F'60	F'62 S'60	S'62 F'60	S'62 S'60	F'62 F'60	F'62 S'60	S'62 F'60	S'62 S'60
BOYS								
3 Subtests	80	12	158	343	87	13	32	68
# 3 Subtests	79	13	149	352	86	14	30	70
Total Test minus /hw/	79	13	165	336	86	14	33	67
Total Consonants	84	8	206	295	91	9	41	59
Initial Consonants	80	12	188	313	87	13	38	62
Final Consonants	84	8	231	270	91	9	46	54
Total Clusters	85	7	222	279	92	8	44	56
/s/ Clusters @	-	-	-	-	-	-	-	-
/l/ Clusters @	-	-	-	-	-	-	-	-
/r/ Clusters @	-	-	-	-	-	-	-	-
GIRLS								
3 Subtests	41	3	205	337	93	7	38	62
Total Test minus /hw/	39	5	180	362	88	12	33	67
Total Consonants	41	3	234	308	93	7	43	57
Initial Consonants	42	2	255	287	95	5	47	53
Final Consonants	39	5	206	336	88	12	38	62
Total Clusters	40	4	151	391	91	9	28	72
/s/ Clusters	38	6	149	393	86	14	27	73
/l/ Clusters @	-	-	-	-	-	-	-	-
/r/ Clusters @	-	-	-	-	-	-	-	-

@ Entire sample included at cut-off.

# Total Test minus /hw/ substituted for Total Test.

Table A-22. Discriminant Function Coefficients of Three Subtests for Prediction in 1962 Imitation Articulation Test, and Cut-Off Values at Selected Percentages for Boys and Girls.

BOYS

Coefficients:		
	Imitation - /1/ Cluster Subtest	.79
	Imitation - Total Score minus /hw/	7.33
	Picture - /1/ Cluster Subtest	-1.29

Cut-off Values:	75 Per Cent	80 Per Cent
Sample A-1	477.36	511.85
Sample A-2	596.76	601.89
Sample B-I	506.66	521.31
Sample B-II	478.27	501.54

GIRLS

Coefficients:		
	Imitation - /1/ Cluster Subtest	-.35
	Imitation - /r/ Cluster Subtest	10.54
	Imitation - Total Consonant Subtest	-.74

Cut-off Values:	75 Per Cent	80 Per Cent
Sample A-1	617.90	634.69
Sample A-2	716.94	733.28
Sample B-I	756.21	764.91
Sample B-II	777.76	787.84

Table A-23. Correlations between Fall 1962 Spencer Articulation Test and Scores on 1960 Picture and Imitation Articulation Subtests for Boys and Girls by Sample.

	Boys				Girls			
Sample:	A-1	A-2	B-I	B-II	A-1	A-2	B-I	B-II
N :	202	209	593	593	282	278	586	586
PICTURE TEST								
P-Total Test	.57	-	-	-	.58	-	-	-
P-Total minus /hw/	.58	.51	.65	.56	.58	.48	.54	.49
P-Total Consonants	.56	.51	.64	.56	.58	.49	.53	.48
P-Initial Consonants	.55	.46	.59	.49	.53	.47	.52	.45
P-Final Consonants	.48	.51	.63	.39	.55	.45	.48	.45
P-Total Clusters	.54	.45	.56	.50	.47	.38	.49	.43
P-/s/ Clusters	.41	.32	.45	.41	.38	.25	.45	.38
P-/1/ Clusters	.46	.37	.44	.41	.36	.43	.35	.35
P-/r/ Clusters	.36	.35	.34	.30	.39	.22	.29	.26
IMITATION TEST								
I-Total Test	.58	.51	.66	.57	.58	.50	.54	.50
I-Total minus /hw/	.58	.51	.66	.58	.58	.50	.54	.50
I-Total Consonants	.56	.51	.66	.58	.60	.49	.52	.50
I-Initial Consonants	.54	.48	.62	.53	.58	.47	.50	.50
I-Final Consonants	.52	.50	.65	.57	.58	.47	.50	.45
I-Total Clusters	.54	.46	.58	.49	.47	.46	.51	.43
I-/s/ Clusters	.45	.35	.49	.42	.37	.28	.46	.39
I-/1/ Clusters	.44	.38	.47	.41	.35	.52	.37	.31
I-/r/ Clusters	.40	.37	.33	.22	.30	.32	.31	.26

Table A-24. Distributions on 1962 Spencer Articulation Test with 75 and 80 Per Cent of Failures Correctly Identified. 17, 3 and Single 1960 Imitation Subtests as Predictors. Boys and Girls, Sample A-1.

	Distribution by Number				Distribution by Per Cent			
75 PER CENT OF FAILURES	F'62 F'60	F'62 S'60	S'62 F'60	S'62 S'60	F'62 F'60	F'62 S'60	S'62 F'60	S'62 S'60
BOYS								
17 Subtests	19	7	18	158	73	27	10	90
3 Subtests	19	7	21	156	73	27	12	88
Total minus /hw/	19	7	23	163	73	27	7	93
Total Consonants	20	6	22	154	77	23	12	88
Initial Consonants	20	6	25	151	77	23	14	86
Final Consonants	20	6	41	135	77	23	23	77
Total Clusters	20	6	36	140	77	23	20	80
/s/ Clusters	20	6	35	141	77	23	20	80
/l/ Clusters @	-	-	-	-	-	-	-	-
/r/ Clusters @	-	-	-	-	-	-	-	-
GIRLS								
17 Subtests	11	4	14	253	73	27	5	95
3 Subtests	11	4	21	246	73	27	8	92
Total minus /hw/	11	4	31	236	73	27	12	88
Total Consonants	11	4	28	239	73	27	11	89
Initial Consonants	11	4	31	236	73	27	12	88
Final Consonants	11	4	38	229	73	27	14	86
Total Clusters	11	4	53	214	73	27	20	80
/s/ Clusters @	-	-	-	-	-	-	-	-
/l/ Clusters @	-	-	-	-	-	-	-	-
/r/ Clusters @	-	-	-	-	-	-	-	-
80 PER CENT OF FAILURES								
BOYS								
17 Subtests	21	5	18	158	81	19	10	90
3 Subtests	21	5	24	153	81	19	14	86
Total minus /hw/	21	5	27	151	81	19	15	85
Total Consonants	21	5	33	115	81	19	36	64
Initial Consonants	24	2	36	142	92	8	20	80
Final Consonants	23	3	64	114	88	12	36	64
Total Clusters	23	3	46	132	88	12	26	74
/s/ Clusters	21	5	43	135	81	19	24	76
/l/ Clusters @	-	-	-	-	-	-	-	-
/r/ Clusters @	-	-	-	-	-	-	-	-
GIRLS								
17 Subtests	12	3	68	199	80	20	26	74
3 Subtests	12	3	45	222	80	20	17	83
Total minus /hw/	12	3	47	219	80	20	18	82
Total Consonants	12	3	64	202	80	20	24	76
Initial Consonants	12	3	96	170	80	20	36	64
Final Consonants	12	3	61	205	80	20	23	77
Total Clusters	12	3	106	160	80	20	40	60
/s/ Clusters @	-	-	-	-	-	-	-	-
/l/ Clusters @	-	-	-	-	-	-	-	-
/r/ Clusters @	-	-	-	-	-	-	-	-

@ Entire sample included at cut-off.

Table A-24 Continued.

85 PER CENT OF FAILURES		Distribution by Number				Distribution by Per Cent			
		F'62 F'60	F'62 S'60	S'62 F'60	S'62 S'60	F'62 F'60	F'62 S'60	S'62 F'60	S'62 S'60
BOYS									
17 Subtests		22	4	29	148	85	15	16	86
3 Subtests		22	4	26	151	85	15	15	85
Total Test minus /hw/		23	3	39	138	88	12	22	78
Total Consonants		24	2	45	132	92	8	25	75
Initial Consonants		24	2	36	141	92	8	20	80
Final Consonants		23	3	64	113	88	12	36	64
Total Clusters		23	3	46	131	88	12	26	74
/s/ Clusters	@	-	-	-	-	-	-	-	-
/l/ Clusters	@	-	-	-	-	-	-	-	-
/r/ Clusters	@	-	-	-	-	-	-	-	-
GIRLS									
17 Subtests		13	2	139	127	87	13	52	48
3 Subtests		13	2	127	139	87	13	48	52
Total Test minus /hw/		13	2	149	117	87	13	56	44
Total Consonants		13	2	142	124	87	13	53	47
Initial Consonants		13	2	145	121	87	13	55	45
Final Consonants		13	2	108	158	87	13	41	59
Total Clusters	@	-	-	-	-	-	-	-	-
/s/ Clusters	@	-	-	-	-	-	-	-	-
/l/ Clusters	@	-	-	-	-	-	-	-	-
/r/ Clusters	@	-	-	-	-	-	-	-	-

@ Entire sample included at cut-off.

Table A-25. Distributions on 1962 Spencer Articulation Test with 75 and 80 Per Cent of Failures Correctly Identified. 17, 3 and Single 1960 Imitation Subtests as Predictors. Boys and Girls, Sample A-2.

	75 PER CENT OF FAILURES								80 PER CENT OF FAILURES							
	Distribution by Number				Distribution by Per Cent				Distribution by Number				Distribution by Per Cent			
	F'62 F'60	F'62 S'60	S'62 F'60	S'62 S'60	F'62 F'60	F'62 S'60	S'62 F'60	S'62 S'60	F'62 F'60	F'62 S'60	S'62 F'60	S'62 S'60	F'62 F'60	F'62 S'60	S'62 F'60	S'62 S'60
BOYS																
17 Subtests	17	6	34	152	74	26	9	91	18	5	48	138	78	22	26	74
3 Subtests	17	6	43	143	74	26	23	77	18	5	48	138	78	22	26	74
Total minus /hw/	17	6	44	142	74	26	24	76	18	5	44	142	78	22	24	76
Total Consonants	17	6	34	152	74	26	9	91	18	5	43	143	78	22	23	77
Initial Consonants	17	6	36	150	74	26	19	81	18	5	60	126	78	22	32	68
Final Consonants	20	3	111	75	87	13	60	40	20	3	111	75	87	13	32	68
Total Clusters	17	6	52	134	74	26	28	72	20	3	83	103	87	13	60	40
/s/ Clusters	@ -	-	-	-	-	-	-	-	@ -	-	-	-	-	-	-	-
/l/ Clusters	@ -	-	-	-	-	-	-	-	@ -	-	-	-	-	-	-	-
/r/ Clusters	@ -	-	-	-	-	-	-	-	@ -	-	-	-	-	-	-	-
GIRLS																
17 Subtests	14	5	36	223	74	26	14	86	15	4	41	218	79	21	16	84
3 Subtests	14	5	33	226	74	26	13	87	15	4	36	223	79	21	13	87
Total minus /hw/	14	5	25	234	74	26	10	90	15	4	58	201	79	21	22	78
Total Consonants	14	5	30	229	74	26	12	88	15	4	32	227	79	21	13	87
Initial Consonants	15	4	30	229	79	21	12	88	15	4	30	229	79	21	12	88
Final Consonants	16	3	62	197	84	16	24	76	16	3	62	197	84	16	24	76
Total Clusters	14	5	46	213	74	26	18	82	16	3	125	134	84	16	48	52
/s/ Clusters	@ -	-	-	-	-	-	-	-	@ -	-	-	-	-	-	-	-
/l/ Clusters	14	5	47	212	74	26	18	82	@ -	-	-	-	-	-	-	-
/r/ Clusters	@ -	-	-	-	-	-	-	-	@ -	-	-	-	-	-	-	-

@ Entire sample included at cut-off

Table A-25 Continued.

85 PER CENT OF FAILURES

		Distribution by Number				Distribution by Per Cent			
		F'62 F'60	F'62 S'60	S'62 F'60	S'62 S'60	F'62 F'60	F'62 S'60	S'62 F'60	S'62 S'60
BOYS									
17 Subtests		20	3	81	104	87	13	44	56
# 3 Subtests		20	3	55	130	87	13	30	70
3 Subtests		20	3	60	125	87	13	32	68
Total Test minus /hw/		20	3	63	122	87	13	34	66
Total Consonants		20	3	95	90	87	13	51	49
Initial Consonants		21	2	104	81	91	9	56	44
Final Consonants		20	3	111	74	87	13	60	40
Total Clusters		20	3	83	102	87	13	45	55
/s/ Clusters	@	-	-	-	-	-	-	-	-
/1/ Clusters	@	-	-	-	-	-	-	-	-
/r/ Clusters	@	-	-	-	-	-	-	-	-
GIRLS									
17 Subtests		16	3	75	184	84	16	29	71
3 Subtests		16	3	51	208	84	16	20	80
Total Test minus /hw/		16	3	92	167	84	16	36	64
Total Consonants		16	3	61	198	84	16	24	76
Initial Consonants		16	3	92	167	84	16	36	64
Final Consonants		16	3	62	197	84	16	24	76
Total Clusters		16	3	125	134	84	16	48	52
/s/ Clusters	@	-	-	-	-	-	-	-	-
/1/ Clusters	@	-	-	-	-	-	-	-	-
/r/ Clusters	@	-	-	-	-	-	-	-	-

@ Entire sample included at cut-off.

Total Test minus /hw/ substituted for Total Test.

Table A-26. Distributions on 1962 Spencer Articulation Test with 75 and 80 Per Cent of Failures Correctly Identified. 3 and Single 1960 Imitation Subtests as Predictors. Boys and Girls, Sample B-I.

	Distribution by Number				Distribution by Per Cent			
75 PER CENT OF FAILURES	F'62 F'60	F'62 S'60	S'62 F'60	S'62 S'60	F'62 F'60	F'62 S'60	S'62 F'60	S'62 S'60
BOYS								
3 Subtests	65	21	88	419	75	25	17	83
Total minus /hw/	65	21	73	434	76	24	14	86
Total Consonants	67	19	107	400	78	22	21	79
Initial Consonants	69	17	141	366	80	20	28	72
Final Consonants	70	16	132	375	81	19	26	74
Total Clusters	67	19	94	413	78	22	21	79
/s/ Clusters	66	20	126	381	77	23	25	75
/l/ Clusters	@ -	-	-	-	-	-	-	-
/r/ Clusters	@ -	-	-	-	-	-	-	-
GIRLS								
3 Subtests	28	9	79	470	76	24	14	86
Total minus /hw/	28	9	69	480	76	24	13	87
Total Consonants	28	9	85	464	76	24	15	85
Initial Consonants	28	9	106	443	76	24	19	81
Final Consonants	30	7	89	460	81	19	16	84
Total Clusters	32	5	129	420	86	14	23	77
/s/ Clusters	28	9	102	447	76	24	19	81
/l/ Clusters	@ -	-	-	-	-	-	-	-
/r/ Clusters	@ -	-	-	-	-	-	-	-
80 PER CENT OF FAILURES								
BOYS								
3 Subtests	69	17	103	404	80	20	20	80
Total minus /hw/	69	17	102	405	80	20	20	80
Total Consonants	72	14	132	375	84	16	26	74
Initial Consonants	69	17	141	366	80	20	28	72
Final Consonants	70	16	132	375	81	19	26	74
Total Clusters	73	13	162	345	85	15	32	68
/s/ Clusters	74	12	160	347	86	14	32	68
/l/ Clusters	@ -	-	-	-	-	-	-	-
/r/ Clusters	@ -	-	-	-	-	-	-	-
GIRLS								
3 Subtests	30	7	99	450	81	19	18	82
Total minus /hw/	30	7	80	469	81	19	15	85
Total Consonants	31	6	103	446	84	16	19	81
Initial Consonants	32	5	191	358	86	14	35	65
Final Consonants	30	7	89	460	81	19	16	84
Total Clusters	32	5	129	420	86	14	23	77
/s/ Clusters	32	5	157	392	86	14	29	71
/l/ Clusters	@ -	-	-	-	-	-	-	-
/r/ Clusters	@ -	-	-	-	-	-	-	-

@ Entire sample included at cut-off.

Table A-26 Continued.

85 PER CENT OF FAILURES	Distribution by Number				Distribution by Per Cent			
	F'62 F'60	F'62 S'60	S'62 F'60	S'62 S'60	F'62 F'60	F'62 S'60	S'62 F'60	S'62 S'60
BOYS								
3 Subtests	76	10	137	370	88	12	27	73
# 3 Subtests	75	11	127	380	87	13	25	75
Total Test minus /hw/	77	9	161	346	90	10	32	68
Total Consonants	76	10	156	351	88	12	31	69
Initial Consonants	78	8	242	265	91	9	48	52
Final Consonants	79	7	185	322	92	8	36	64
Total Clusters	76	10	162	345	88	12	32	68
/s/ Clusters	74	12	160	347	86	14	32	68
/l/ Clusters @	-	-	-	-	-	-	-	-
/r/ Clusters @	-	-	-	-	-	-	-	-
GIRLS								
3 Subtests	32	5	156	393	86	14	28	72
Total Test minus /hw/	32	5	114	435	86	14	21	79
Total Consonants	33	4	131	418	89	11	24	76
Initial Consonants	32	5	191	358	86	14	35	65
Final Consonants	33	4	226	323	89	11	41	59
Total Clusters	32	5	129	420	86	14	23	77
/s/ Clusters	32	5	157	392	86	14	29	71
/l/ Clusters @	-	-	-	-	-	-	-	-
/r/ Clusters @	-	-	-	-	-	-	-	-

@ Entire sample included at cut-off.

# Total Test minus /hw/ substituted for Total Test.

Table A-27. Distributions on 1962 Spencer Articulation Test with 75 and 80 Per Cent of Failures Correctly Identified. 3 and Single 1960 Imitation Subtests as Predictors. Boys and Girls, Sample B-II.

	Distribution by Number				Distribution by Per Cent			
75 PER CENT OF FAILURES	F'62 F'60	F'62 S'60	S'62 F'60	S'62 S'60	F'62 F'60	F'62 S'60	S'62 F'60	S'62 S'60
BOYS								
3 Subtests	65	21	94	413	75	25	19	81
Total minus /hw/	68	18	103	404	79	21	20	80
Total Consonants	67	19	111	396	78	22	22	78
Initial Consonants	66	20	100	407	77	23	20	80
Final Consonants	71	15	166	341	83	17	33	67
Total Clusters	66	20	128	379	77	23	25	75
/s/ Clusters	71	15	216	291	83	17	43	57
/l/ Clusters	71	15	203	304	83	17	40	60
/r/ Clusters @	-	-	-	-	-	-	-	-
GIRLS								
3 Subtests	28	9	121	428	76	24	22	78
Total minus /hw/	28	9	58	491	76	24	11	89
Total Consonants	28	9	89	460	76	24	16	84
Initial Consonants	29	8	101	448	78	22	18	82
Final Consonants	28	9	131	418	76	24	24	76
Total Clusters	29	8	162	387	78	22	30	70
/s/ Clusters	30	7	156	393	81	19	28	72
/l/ Clusters @	-	-	-	-	-	-	-	-
/r/ Clusters @	-	-	-	-	-	-	-	-
80 PER CENT OF FAILURES								
BOYS								
3 Subtests	69	17	99	408	80	20	20	80
Total minus /hw/	70	16	111	396	81	19	22	78
Total Consonants	69	17	145	362	80	20	29	71
Initial Consonants	74	12	162	345	86	14	32	68
Final Consonants	71	15	162	345	83	17	32	68
Total Clusters	74	12	184	323	86	14	36	64
/s/ Clusters	71	15	216	291	77	23	43	57
/l/ Clusters	71	15	203	304	77	23	40	60
/r/ Clusters @	-	-	-	-	-	-	-	-
GIRLS								
3 Subtests	30	7	126	423	81	19	23	77
Total minus /hw/	30	7	84	465	81	19	15	85
Total Consonants	30	7	152	397	81	19	28	72
Initial Consonants	31	6	121	428	84	16	22	78
Final Consonants	33	4	212	337	89	11	39	61
Total Clusters	32	5	190	359	86	14	39	61
/s/ Clusters	30	7	156	393	81	19	28	72
/l/ Clusters @	-	-	-	-	-	-	-	-
/r/ Clusters @	-	-	-	-	-	-	-	-

@ Entire sample included at cut-off.

Table A-27 Continued.

85 PER CENT OF FAILURES	Distribution by Number				Distribution by Per Cent			
	F'62 F'60	F'62 S'60	S'62 F'60	S'62 S'60	F'62 F'60	F'62 S'60	S'62 F'60	S'62 S'60
BOYS								
3 Subtests	74	12	112	395	86	14	22	78
# 3 Subtests	74	12	114	393	86	14	22	78
Total Test minus /hw/	74	12	130	377	86	14	26	74
Total Consonants	74	12	216	291	86	14	43	57
Initial Consonants	74	12	162	345	86	14	32	68
Final Consonants	79	7	235	272	92	8	46	54
Total Clusters	74	12	184	323	86	14	36	64
/s/ Clusters @	-	-	-	-	-	-	-	-
/l/ Clusters @	-	-	-	-	-	-	-	-
/r/ Clusters @	-	-	-	-	-	-	-	-
GIRLS								
3 Subtests	34	3	216	333	92	8	39	61
Total Test minus /hw/	33	4	213	336	89	11	39	61
Total Consonants	35	2	240	309	95	5	44	56
Initial Consonants	36	1	261	288	97	3	48	52
Final Consonants	33	4	212	337	89	11	39	61
Total Clusters	32	5	190	359	86	4	35	65
/s/ Clusters @	-	-	-	-	-	-	-	-
/l/ Clusters @	-	-	-	-	-	-	-	-
/r/ Clusters @	-	-	-	-	-	-	-	-

@ Entire sample included at cut-off.

# Total Test minus /hw/ substituted for Total Test.

Table A-28. Discriminant Function Coefficients of Three Subtests for Prediction on 1962 Spencer Articulation Test, and Cut-Off Values at Selected Percentages for Boys and Girls.

BOYS

Coefficients:	Imitation - /l/ Cluster Subtest	2.06
	Imitation - Total Score minus /hw/	6.04
	Picture - /l/ Cluster Subtest	-2.08

Cut-off Values:	75 Per Cent	80 Per Cent
Sample A-1	433.02	451.57
Sample A-2	498.95	499.88
Sample B-I	422.25	433.46
Sample B-II	396.40	404.14

GIRLS

Coefficients:	Imitation - /l/ Cluster Subtest	-.29
	Imitation - /r/ Cluster Subtest	7.12
	Imitation - Total Consonant Subtest	.04

Cut-off Values:	75 Per Cent	80 Per Cent
Sample A-1	515.12	572.12
Sample A-2	547.55	548.61
Sample B-I	537.26	565.37
Sample B-II	538.31	550.74

Table A-29. Correlations between Fall 1962 Intelligibility Rating and Scores on 1960 Picture and Imitation Articulation Subtests for Boys and Girls by Sample.

	Boys Samples				Girls Samples			
PICTURE TEST	A-1	A-2	B-I	B-II	A-1	A-2	B-I	B-II
P-Total Test	-.26	-	-	-	-.24	-	-	-
P-Total minus /hw/	-.26	-.27	-.42	-.33	-.24	-.37	-.32	-.26
P-Total Consonants	-.24	-.28	-.42	-.32	-.23	-.39	-.30	-.24
P-Initial Consonants	-.19	-.27	-.37	-.30	-.20	-.37	-.25	-.21
P-Final Consonants	-.24	-.26	-.43	-.26	-.24	-.36	-.30	-.22
P-Total Clusters	-.25	-.22	-.35	-.31	-.21	-.29	-.32	-.26
P-/s/ Clusters	-.21	-.12	-.27	-.22	-.19	-.13	-.27	-.20
P-/l/ Clusters	-.14	-.21	-.27	-.24	-.14	-.33	-.19	-.19
P-/r/ Clusters	-.22	-.17	-.24	-.23	-.12	-.26	-.24	-.20
IMITATION TEST								
I-Total Test	-.21	-.26	-.41	-.37	-.24	-.39	-.29	-.23
I-Total minus /hw/	-.21	-.26	-.41	-.37	-.24	-.39	-.30	-.24
I-Total Consonants	-.19	-.26	-.41	-.36	-.24	-.37	-.27	-.23
I-Initial Consonants	-.20	-.22	-.37	-.35	-.23	-.39	-.24	-.21
I-Final Consonants	-.16	-.27	-.42	-.35	-.23	-.33	-.27	-.20
I-Total Clusters	-.22	-.24	-.35	-.32	-.19	-.38	-.32	-.26
I-/s/ Clusters	-.18	-.15	-.27	-.26	-.18	-.19	-.24	-.18
I-/l/ Clusters	-.09	-.20	-.28	-.26	-.12	-.39	-.20	-.20
I-/r/ Clusters	-.25	-.24	-.24	-.13	-.09	-.34	-.28	-.22

Table A-30. Number and Per Cent of Successful and Unsuccessful Predictions Based on Cut-Off at 75, 80, and 85 Per Cent of Failures on 1962 Intelligibility Rating for 17 Articulation Subtests, Boys and Girls by Samples.

	Number of Predictions				Percentage of Predictions			
	F'62	F'62	S'62	S'62	F'62	F'62	S'62	S'62
	F'60	S'60	F'60	S'60	F'60	S'60	F'60	S'60
				75 PER CENT CUT-OFF				
Boys Sample A-1	15	5	47	135	75	25	26	74
Boys Sample A-2	13	5	60	131	72	28	31	69
Girls Sample A-1	10	4	63	205	71	29	24	76
Girls Sample A-2	11	4	127	136	73	27	48	52
				80 PER CENT CUT-OFF				
Boys Sample A-1	16	4	86	96	75	25	47	53
Boys Sample A-2	14	4	62	129	78	22	38	68
Girls Sample A-1	11	3	82	185	79	21	31	69
Girls Sample A-2	12	3	127	136	80	20	48	52
				85 PER CENT CUT-OFF				
Boys Sample A-1	17	3	91	91	85	15	50	50
Boys Sample A-2	15	3	83	108	83	17	43	57
Girls Sample A-1	12	2	119	148	86	14	45	55
Girls Sample A-2	13	2	162	101	87	13	62	38

UNIVERSITY OF MINNESOTA
INSTITUTE OF CHILD DEVELOPMENT AND WELFARE
MINNEAPOLIS 14

March 15, 1960

(Letter to Principals)

As you know, the question of when to begin speech therapy with elementary school children is a recurring one. A study which will attempt to identify at the kindergarten level those children who are most likely to need speech therapy in second or third grade will begin this Spring. The United States Office of Education has granted financial support for this project. Dr. Mildred C. Templin of the Institute of Child Development and Welfare, University of Minnesota, who for many years has studied the development of speech sound articulation and who was a public school speech therapist is the principal investigator. The study was planned in cooperation with the Minneapolis speech therapists and Dr. Evelyn Deno.

The study as planned, will begin this Spring and continue through 1962. Within the next few months, it is necessary to measure the speech sound articulation of a large number of children who will enroll in kindergarten in September. Using this survey as a basis, approximately 300 kindergarten children will be selected in the fall to form three groups of children to be followed during their kindergarten and first grade years. One group will be made up of children with essentially normal speech; one group of children who are quite consistent in their misarticulation of speech sounds; and a third group of children who are inconsistent in their misarticulations. It is believed that the consistency of correct or incorrect articulation may be one factor in determining whether a given kindergarten child will improve in his speech sound articulation without therapy. No therapy is included in the study.

During the next two years, data assembled for each of the 300 children will include an extensive evaluation of articulation, an assessment of general language development, motor tests of the speech organs, measures of speech sound discrimination, auditory memory span, attention span and listening ability, standard reading and intelligence tests, a teacher rating of each child's speech performance, and an interview with his parents. Twice each year the speech sound articulation of these 300 selected children will be tested. At the beginning of second grade, as many as possible of the total number of children whose speech sound articulation will be measured this spring, will again be tested.

The immediate problem is to locate and test the speech sound articulation of a substantial proportion of those children who will enroll in the kindergartens in the Minneapolis public schools in

September. The articulation test will take between five and ten minutes to administer to each child. It will be given by qualified speech therapists, most of whom have had some public school experience, but who are not now employed in the Minneapolis schools. This year the various elementary schools have different plans for spring school visitation of children to be enrolled in kindergarten in fall. We are asking your help in making possible the articulation testing of these children this spring. With each principal willing to participate, we will work out such things as time of testing and contacts with parents so that, insofar as possible, they will fit into any existing school plans. The testing itself is of such character that it would represent a valid "school task" to a child being oriented to the school situation. The test could be quickly given if the mother were to bring the child to school to "visit."

Could you please fill out the attached one-page questionnaire and return it to Dr. Deno by March 22nd? We hope that your school will be able to participate in this aspect of the study since we believe the project will provide valuable information both for helping children with speech problems and for the maximal use of the time of public school speech therapists. If there is a speech clinician in your building, he will know of the study and may be able to answer any questions you may have. If not, direct inquiries to Dr. Deno or Mrs. Myfanwy Chapman.

Sincerely yours,

Mildred C. Templin
Professor

MINNEAPOLIS PUBLIC SCHOOLS DEPARTMENT OF SPECIAL EDUCATION

Please fill in and return by Tuesday, March 22 to Dr. Evelyn Deno, Consultant in Special Education, Board of Education.

School____________________________Principal____________________________

Address____________________________________Telephone__________________

1. As part of a study aimed at identifying in kindergarten those children likely to need speech therapy later, are you willing that children who will enroll in kindergarten in your school next September be included in the speech sound articulation survey to be made this Spring?____________________

2. If you are willing that fall entry kindergarten children from your district be included in the study, please fill out the rest of this page. Dr. Templin or Dr. Deno's office will contact you to work out details. This information, however, will aid in initial planning of the testing schedule.

   A. How many kindergarten children do you estimate would be
   available for te
   available for testing?____________________

   B. Would testing of these children fit into your Spring round-up plans?

   If so, please give information concerning the dates set up for visits, time of day, and the number of testers who could be accomodated. (A quiet spot would be needed for testing.)

   C. If you are not having children come to school for orientation this Spring, by what date do you expect to have the names of children likely to enroll in kindergarten in September?______
   ____

   Can you suggest any other ways in which children from your district might be surveyed this Spring?

   D. Additional comments.

Minneapolis Public Schools
Department of Special Education

Institute of Child Development
University of Minnesota

Information on Speech Study

Most children do not pronounce all English sounds correctly when they start kindergarten. Some children are easily understood, and some can be understood only with considerable difficulty. Not until most children are in second or third grade can they be expected to pronounce practically all their sounds correctly. It cannot readily be told which of the children of kindergarten age will pronounce their sounds correctly in two or three years and which will be difficult to understand.

Dr. Mildred Templin from the Institute of Child Development at the University of Minnesota is attempting to indentify those children now ready to enter kindergarten who will and those who will not need speech correction when they are in second grade. To do this it is necessary to evaluate the speech of a large number of children now, to observe and study a smaller number during the next two years, and to evaluate the speech of the larger group again in two years. This study is being supported by the United States Office of Education. Schools throughout Minneapolis are participating. The school to which your child will go to kindergarten is being asked to cooperate.

On certain days this spring several persons will be at the school to carry on speech evaluations of children. Parents are asked to bring their children for this purpose. Each evaluation will take about ten minutes. For the study, children who speak well and those who speak very poorly are needed. Having your child's speech evaluated does not mean either that he should or that he will have speech correction. There is no therapy connected with the study. Bringing your child for speech evaluation, however, is an opportunity for you to help in obtaining information on the development of speech in children which should be useful in providing an even more efficient speech correction program for the Minneapolis schools.

PRE-KINDERGARTEN ARTICULATION SURVEY

Name______________________ B G Date____________School_____________Examiner______

Father's Name______________ Address______________Occupation______________________

Birthdate_________ Sibs______ Position____________ SES______ Vowels______________

Intelligibility: 1 2 3 Comments____

Non-fluencies: None Several Many **Grimaces**: None Several Many

Tonic Blocks: None Several Many **Clinic Blocks**: None Several Many

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PICTURE TEST (Same as Imitation Test)

1. chair ____
   ____
2. leaf ____
   ____
3. flag ____
   ____
4. glass ____
   ____
5. train ____
   ____
6. bridge ____
   ____
7. smoke ____
   ____
8. window ____
9. roof ____
10. there ____
11. stove ____
12. smooth
13. slide ____
    ____
14. string ____
    ____
15. nose ____
16. thumb ____
    ____
17. teeth ____
18. zipper ____
19. vacuum cleaner ____
20. shovel ____
21. sandwich ____
22. cup ____
23. measure ____
24. tub ____
25. jack-in-the-box ____
26. fish ____
27. wheel ____
    ____
28. hat ____
    ____
29. yellow ____

Key

nr = no response

- = omitted sound

✓ = incorrect sound

x = lateral s

KINDERGARTEN ARTICULATION TEST

Name____________ B G Address____________ School__________ Examiner____

Father's Name____________ Address____________ Occupation____________

Birthdate__________ Sibs______ Position________ SES______ Vowels________

Intelligibility: 1 2 3 Comments____________

Non-fluences: None Several Many **Grimaces:** None Several Many

Tonic Blocks: None Several Many **Clonic Blocks:** None Several Many

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PICTURE TEST

1. chair ch____
r____

2. leaf l____
f____

3. flag l____
g____

4. glass l____
s____

5. train r____
n____

6. bridge r____
dzh ____

7. smoke s____
k____

8. window w____

9. roof r____

10. there th____

11. stove s____
v____

12. smooth th____

13. slide s____
l____
d____

14. string s____
r____
ng____

15. nose n____
s____

16. thumb th____
m____

17. teeth t____
th____

18. zipper z____
r____

19. vacuum cleaner v____

20. shovel sh____
l____

21. sandwich
s____
ch____

22. cup k____
p____

23. measure m____
zh____

24. tub b____

25. jack-in-the box dzh____

26. fish f____
sh____

27. hat h____
t____

28. yellow y____

29. pencil p____

30. bell b____
l____

31. dog d____

32. garage g____
zh____

33. wheel wh____

Key

nr = no response

- = omitted sound

IPA sym. = substituted sound

x = distorted sound

SPENCER SPEECH SOUND DISCRIMINATION TEST

Name________________________ Date__________ Examiner__________ No.______

INSTRUCTIONS: Say, "Now I'm going to say some words that don't mean anything. You listen very carefully and then you tell me what I said. Say just what I say." Give the first nonsense word. If there is no response, urge, by saying, "You say it." If there is still no response, say "Tell me zep." As soon as the child begins to respond promptly drop the carrier phrase and simply give the nonsense word for him to imitate. Place a (+) after the nonsense word if the response is correct. If it is incorrect record the response phonetically if possible. If it is not possible to transcribe the response draw a line through the incorrect sound. Thus "~~z~~ep" indicates that the "z" was inaccurately produced. Transcribe the errors whenever possible. Give all 23 items.

1. zɛp ______________
2. pɔʊʃ ______________
3. ðɔɪ ______________
4. ræʒə ______________
5. ʃaɝ ______________
6. ɔʊdʒ ______________
7. θɝ ______________
8. læz ______________
9. mitʃ ______________
10. hɔb ______________
11. nuf ______________
12. tʃɔɪd ______________
13. hʊʊʒ ______________
14. dɛv ______________
15. dʒaɪk ______________
16. weɪm ______________
17. git ______________
18. taʊg ______________
19. jil ______________
20. fɛs ______________
21. kʌŋ ______________
22. san ______________
23. voʊθ ______________

Summary of Errors:

	I	F
Nasals		
Plosives		
Fricatives		
Combinations		
Semivowels		

Number of vowel errors __________

Total correct __________